

LETTERFORMS &

LETTERFORMS & ILLUSION

Scott Kim and Robin Fe Samelson

A series of visual
puzzles, images,
activities, and fonts
from the fascinating
world of perception
and symmetry
Designed for use with
any Macintosh®
computer

identical

mother

waterfall

digital
infinity

ESUCER
ESUCER
ESUCER
ESUCER

WHEEL
WHEEL
WHEEL
WHEEL

R

fff

b

23

A

G

fffff

d

esuc
esuc

P

R

esuc
esuc

N

23

MOV

E

q

+

X

S

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Letterforms & Illusion

Scott Kim and
Robin Fe Samelson

! Happy Flipping!
Scott Kim

W. H. Freeman and Company
New York

We hope you find
an infinite amount
of fun inside Letterforms.
Best wishes,
Robin Samelson

DEDICATION

To our families

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THIS MANUAL

Was written, edited and composed on an Apple Macintosh Plus and SE, in *Ready, Set, Go! 4.0*

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Contents

4	Preface
6	Introduction
8	Software Overview
10	Getting Started
12	Installing the Paint Program
14	Flips
16	Fonts
18	Illusion
20	Flipfont
22	Close-up
24	Parts
26	Blend
28	Boxes
30	Tessellation
32	Escher
34	Infinity
36	Edmond
38	Kits
40	Answers
47	Bibliography
48	About the Authors

Preface

Bernard DeKoven

What do you get when you combine computer science with calligraphy, mathematics, and a penchant for puzzles?

You get an opportunity to play your way to a new level of sensitivity and understanding: sensitivity to the beauty of the written word and understanding of the mathematics of its design.

Letterforms & Illusion is a collection of perceptual puzzles that will challenge and ultimately change your perception of the nature and functions of the alphabet. By toying with each of the many delightful puzzles and activities, you will be taking a computer-enhanced journey into a Wonderland of typography.

Until the publication of this work, this particular Wonderland could only be visited by those who had the practiced hand of a scribe and the conceptual mastery of a font designer. Assisted by the magic of the Macintosh, you now need only a good eye and a sharp mind for your journey.

You begin by playing. Turn on your computer, put in the disk, open the book, and hold on to your mouse.

The first plaything you will encounter will be the software program that sold the Macintosh into the hearts and homes of America: MacPaint. If you have never seen or used this program before, you will learn how to use it without even trying. The activities in the disk are carefully

sequenced so that each new puzzle builds on the knowledge you gained solving the previous puzzles. As you progress through the sequence, you will also gain the mechanical knowledge needed to understand MacPaint and the conceptual knowledge that is key to understanding the principles of graphic design. If you are already familiar with this software, prepare to experience it in a very new light. The *Letterforms* desk accessory, called *Flips*, acts as a special interface to MacPaint, transforming MacPaint to what might be called "MacPuzzler." What was once a simple but powerful graphics program now also becomes a new medium for interactive puzzles and exercises in creative play.

Some of the puzzles in this collection are extremely challenging. Others are simply surprises: opportunities to share the author's delight in and fascination with the play between the forms and meanings of writing. There are dozens of different kinds of puzzles, each one serving as a template for the creation of whole collections of uniquely challenging, educational, sensitizing exercises in reason and design.

If you happen to be a teacher or a parent, you'll find that many of the properties that make this publication enjoyable for you also make it educational for your children. The ease of learning, the playful invitation to explore the elements of design, and the re-visioning of the shape and functions of letters all contribute to making this a truly educational product. As supplementary

activities, the puzzles are as well suited to the mathematics curriculum as they are to language and creative arts. Children will find endless delight in using the collection of special fonts to make more puzzles and designs or to compose secret messages.

There's a lot to play with here, a lot of new visions and ideas. So take your time, enjoy. If you can't solve a puzzle, see what else you can do with it. After all, you're working on probably the most player-friendly business computer ever made. Take advantage of the interactivity. Whatever you do you can undo. If you can't solve something immediately, chances are that you will discover the solution simply by toying with the pieces. Copy things, move things, flip things around. Maybe you'll make up a new puzzle or an eye-and-mind-catching design or a new font or discover a new form of calligraphy. Whatever happens, merely by playing you will acquire a deeper appreciation and perhaps a new love for the design and delight of letters. You will also have a lot of fun.

Introduction

Scott Kim

In 1981 I wrote the book *Inversions*. Inversions are words written so they can be read in more than one way. Here is an inversion on *mac* that reads the same upside down:

mac

In 1984, Robin Fe Samelson suggested we write software based on *Inversions*. Robin wanted to learn how inversions work; I wanted to explore the Macintosh computer as a medium for creating interactive books. Surely we could do something interesting together. But what?

Could we write a program to automatically invent inversions on any word it was given? An intriguing idea, but getting a computer to understand the subtleties of letterform design would be far too hard. Besides, automating the process would take the fun out of it. What about a disk of designs from the book? Too passive. How about fonts based on lettering styles in *Inversions*? Good idea, but fonts by themselves would not offer enough focus.

We decided to create a disk of puzzles based on original fonts. We built our puzzles in MacPaint, which had everything we needed for flipping and manipulating letterforms. MacPaint was a bit cumbersome for some of our needs, so we added a new Flips menu to MacPaint with shortcuts for frequently used commands.

Most people know MacPaint as an entertaining, easy-to-use program for doodling. But it is much deeper.

When I first tried MacPaint in 1984, I timidly poked at all the tools to see what they did. I stopped once I had filled the screen with squiggles, satisfied that I had seen all there was to see. But hiding in the keyboard were special keys that would turn MacPaint into a powerful tool for rapidly transforming images. In *Letterforms & Illusion*, you will learn some of these advanced techniques.

Inversions are no strangers to computers. About a third of the images in *Inversions* were originally drawn with computer programs I wrote at the Xerox Palo Alto Research Center with help from John Warnock, the creator of PostScript. The programs were written in John's programming language JaM, the precursor to PostScript. To program the images, I had to assemble them first in my mind's eye. In the Kits section of *Letterforms & Illusion*, you can experience some of the visualization challenges I faced.


Some of the fonts in *Letterforms & Illusion* were adapted from particular designs from *Inversions*, such as Infinity and Escher. Other fonts were created specifically for play on the screen, such as Flipfont and Illusion. We have invented puzzles to show some of the ways you can play with the fonts.

Now it is your turn to explore. What games can you discover that we never dreamed of?

Robin Fe Samelson

If it weren't for flowers there wouldn't be bees and if it weren't for bees there wouldn't be flowers. Isn't there some way of expressing the relationship between flowers and bees in a single word?

I was struck by this question in a lecture given by a visiting biology professor from Sonoma State University while I was taking classes in botanical medicine at a nearby school. As I listened, a form began taking shape in my mind. In a few minutes, out came the flower/bee design:



I showed it to the lecturer after class. "This is a way to express the infinite loop in that idea," I thought. I gave him the design. He smiled and thanked me.

I like explaining things. When I met Scott, I became interested in explaining how to do inversions in a way that would invite others to participate in the process. First I identified the types of thinking that go into making inversions. Then Scott and I developed games around each type of thinking.

For example, we are all taught to make letters according to strict rules about what a "proper" letter looks like. But the letters that make up inversions are hardly proper. How can you learn to stretch your idea of what a letter can look like? One way is to play with parts of letters instead of whole letters. Hence, Scott developed the font called *Parts*.

Parts lets you see letters in a new light. Instead of vowels and consonants, you learn to see straight lines and curved lines.

The puzzles and fonts in *Letterforms* are designed to be fun and to encourage your creativity. They may even give you a new way of expressing yourself, as they did for me with the flower/bee design. My playing has led me to collecting pictures made from the fonts for a book of font art. If you would like information on how to submit pictures for the font art book, our address is Look Twice, P.O. Box 50697, Palo Alto, CA 94303.

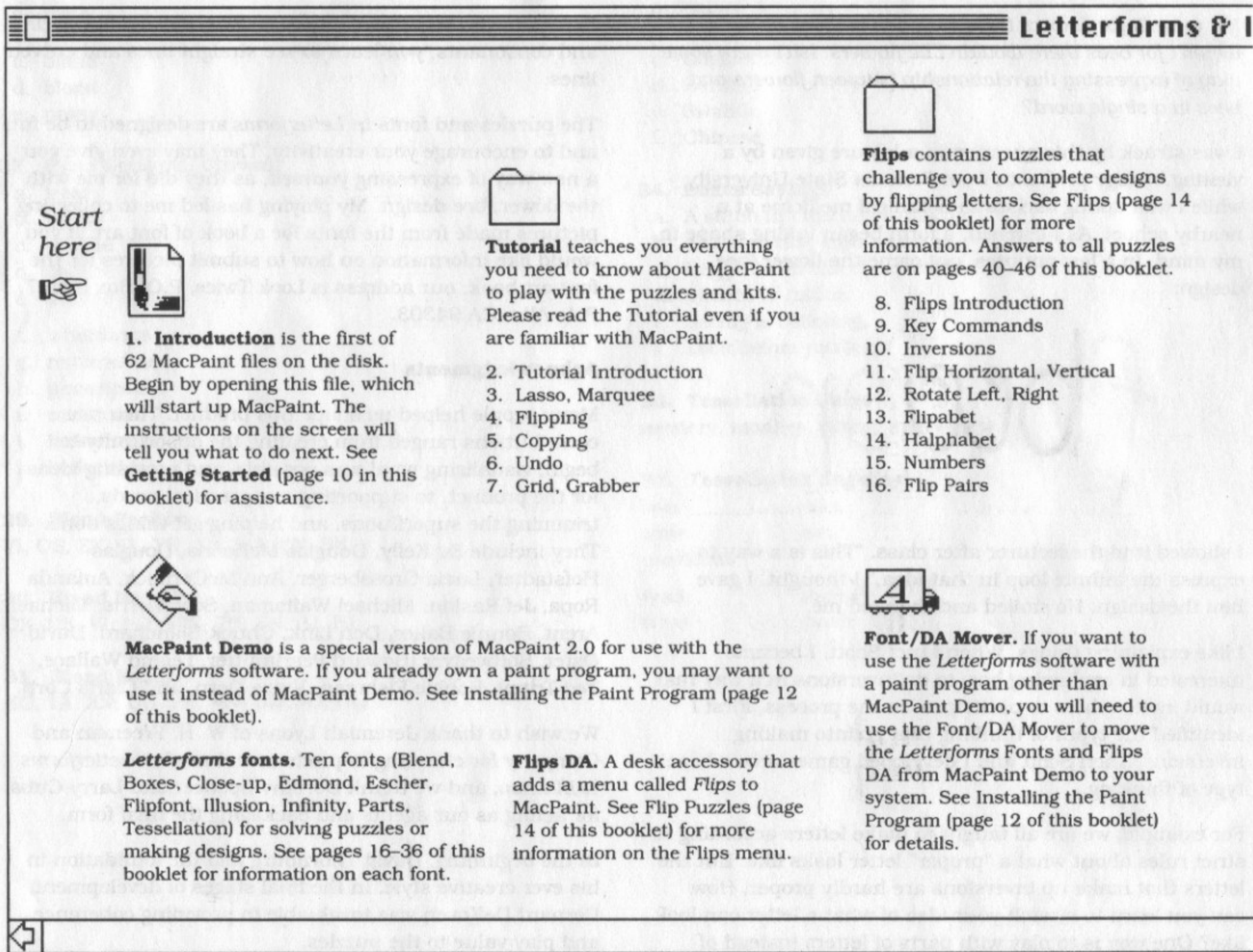
Acknowledgments

Many people helped us shape this product. Their contributions ranged from creating the opportunity to begin, visualizing what was possible, and providing ideas for the product, to supporting our practical needs, trimming the superfluous, and helping get things done. They include Ed Kelly, Douglas McKenna, Douglas Hofstadter, Lucia Grossberger, Ann McCormick, Amanda Ropa, Jef Raskin, Michael Waitsman, Scot Morris, Michael Arent, Bonnie Baker, Don Link, Chuck Blanchard, David Oster, Softweaver (Howard Pearlmuter, Leland Wallace, Ted Tripp), Bobbie Fishman, Vince Dorn, and Claris Corp.

We wish to thank Jeremiah Lyons of W. H. Freeman and Company for choosing to produce and market *Letterforms & Illusion*, and we thank Dorothy Spencer and Larry Cuba for acting as our agents and packaging the final form.

In the beginning, David Thornburg laid the foundation in his ever creative style. In the final stages of development, Bernard DeKoven was invaluable in providing coherence and play value to the puzzles.

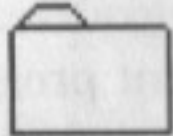
Software Overview



The *Letterforms & Illusion* disk contains

- 62 MacPaint files
- 10 fonts
- Flips desk accessory
- MacPaint Demo
- Font/DA Mover

is & Illusion



Fonts contains games and puzzles based on the *Letterforms* fonts. The Illusion and Flipfont games introduce ways to play with fonts. The Close-up, Parts, Blend, and Boxes puzzles invite you to see the shapes in letters. The Tessellation, Escher, and Infinity puzzles challenge you to weave designs out of letters. See pages 16–36 of this booklet for details on each font. Answers to puzzles are on pages 40–46.

17. Fonts Introduction



Illusion

- 18. Illusion Introduction
- 19. Illusion Stretch
- 20. Illusion Examples



Flipfont

- 21. Flipfont Introduction
- 22. Flipfont Typing



Close-up

- 23. Close-up Introduction
- 24. Close-up Match



Parts

- 25. Parts Introduction
- 26. Parts Upper, Lower
- 27. Parts Straight, Curved



Blend

- 28. Blend Introduction
- 29. Blend Positive
- 30. Blend Negative
- 31. Blend Mixed



Boxes

- 32. Boxes Introduction
- 33. Boxes Languages
- 34. Boxes Sayings



Kits are collections of letter parts for building designs from *Inversions*. See pages 38–39 of this booklet for completed designs.

- 49. Kits Introduction
- 50. Upside Down
- 51. Einstein
- 52. Mozart
- 53. Gutenberg
- 54. Mirror
- 55. Problem
- 56. Escher
- 57. Synergy
- 58. Infinity
- 59. Pilobolus
- 60. Figure
- 61. Tree



62. The End. When you are done with this disk, you can go on to create your own puzzles and designs. See *Making Your Own Puzzles* (page 37 of this booklet) for tips.



Tessellation

- 35. Tessellation Introduction
- 36. Tessellation Jams
- 37. Tessellation Negative
- 38. Tessellations 1
- 39. Tessellations 2



Escher

- 40. Escher Introduction
- 41. Escher Crosswords 1
- 42. Escher Crosswords 2
- 43. Escher Pinwheels
- 44. Escher Patterns



Infinity

- 45. Infinity Introduction
- 46. Infinity Flipping
- 47. Infinity Typing
- 48. Infinity Modifying

Getting Started

Step 1. You Will Need

Macintosh. *Letterforms & Illusion* works with all Apple Macintosh computers. An external disk drive or hard disk drive is helpful but not necessary.

Macintosh experience. We assume you are already familiar with the basics of using your Macintosh. If you need assistance, please consult your *Macintosh Owner's Guide*. MacPaint experience is helpful but not necessary.

Working copy. Make a working copy of the *Letterforms & Illusion* disk by copying the entire contents of the disk onto a blank disk or into a folder on your hard disk. Keep the original disk as a backup copy and use only the working copy. By keeping a backup copy, you will always have an untouched version of the original software.

Inversions (optional). This software is based on the book *Inversions* by Scott Kim. If you have a copy, keep it handy for reference. You do not need the book to use the software. For information on *Inversions*, see page 47.

Step 2. Preparing to Use MacPaint

To use the software, you will need to use a paint program. *Letterforms & Illusion* comes with a special version of MacPaint 2.0, called *MacPaint Demo*, courtesy of Claris Corporation. For most purposes, this paint program is entirely adequate for use with the *Letterforms* software.

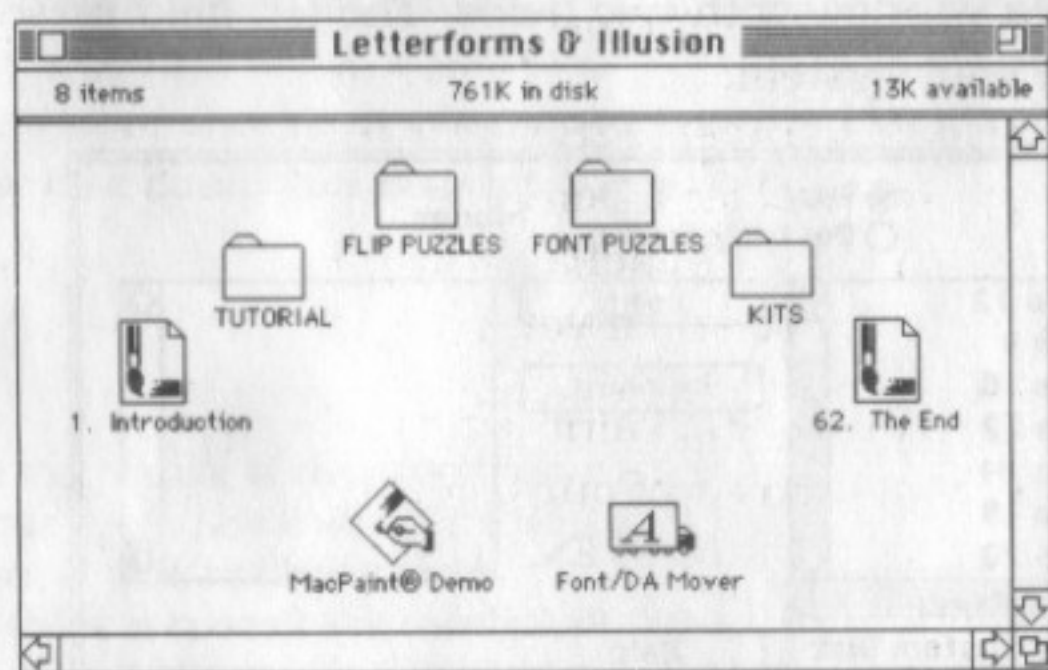
In the following cases, however, you may prefer to use your own painting program instead of MacPaint Demo.

- If you own a Macintosh 128K or 512K you will not be able to use MacPaint Demo. In this case you must use your own copy of MacPaint (version 1.5 or earlier), which was included when you bought your computer.
- If you already own MacPaint you may want to use your paint program instead of ours, since our MacPaint cannot save or print files. Except for saving and printing, MacPaint Demo is exactly the same as MacPaint 2.0.

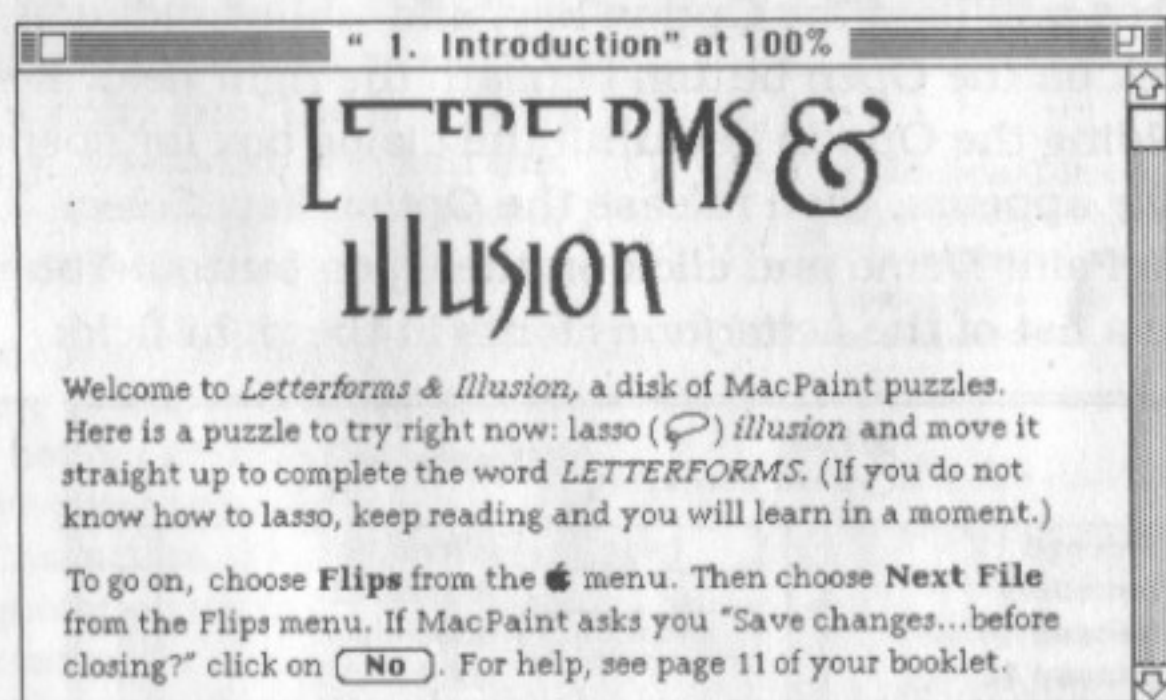
To use *Letterforms & Illusion* with MacPaint Demo no special preparation is necessary and you may go on to Step 3. To use *Letterforms & Illusion* with a paint program other than MacPaint Demo you must first install the other paint program. See **Installing the Paint Program** (page 12 of this booklet) for instructions.

Step 3. Opening MacPaint

- Turn on the Macintosh. If you have copied the *Letterforms* software onto a hard disk, open the *Letterforms* folder. If you are not using a hard disk, insert a system disk into a drive, then insert your working copy of the *Letterforms* disk into a drive.
- After a few moments you will see this window:



- Open "Introduction" by double-clicking its icon. In a moment MacPaint will start up and you will see:



- You are ready to play. Follow the instructions on the screen to go from puzzle to puzzle. Refer to this booklet for more information on particular puzzles and fonts. Answers are at the back of this booklet. Have fun!

Tips for Using the Software

Starting over. To start a puzzle over, choose Revert from the Edit menu to restore the file to its original form.

Flipping. Before you flip or rotate an image, first select it with the marquee. Some flip commands cause the image to flip several times before reaching the correct position.

Grid. Keep Grid (in the Goodies menu) turned on to make it easy to select images with the marquee. Turn Grid off if you want to move an image a small distance. If Grid fails to work properly, try turning it off and back on.

Flips menu. If Flips is not in the Apple menu, you need to move the Flips desk accessory (DA) to your system by using the Font/DA Mover. See Installing the Paint Program (page 12 of this booklet) for instructions. Without Flips, the key commands for opening files and for flipping images will not work, nor will the Blend font look right.

Typing. If the letters you type look wrong on the screen you may have changed the font style inadvertently. To reset the style, choose Plain, 12 point, and Align Left from the Style menu.

Printing and saving files from MacPaint Demo.

MacPaint Demo will not let you save or print files. To save or print an image, use the Scrapbook to transfer the image to another program: Select the image, choose **Copy** from the Edit menu, choose the **Scrapbook** from the menu, and choose **Paste** from the Edit menu. Quit MacPaint and open another paint program, word processor, or other application that allows you to paste images. Choose the **Scrapbook** from the menu, choose **Copy** from the Edit menu, close the Scrapbook, and choose **Paste** from the Edit menu. Then choose **Save** or **Print** from the File menu. If you frequently want to save or print images, you will find it more convenient to use your own paint program. See page 12 of this booklet for details.

Installing the Paint Program

Step 1. Preparing the Disks

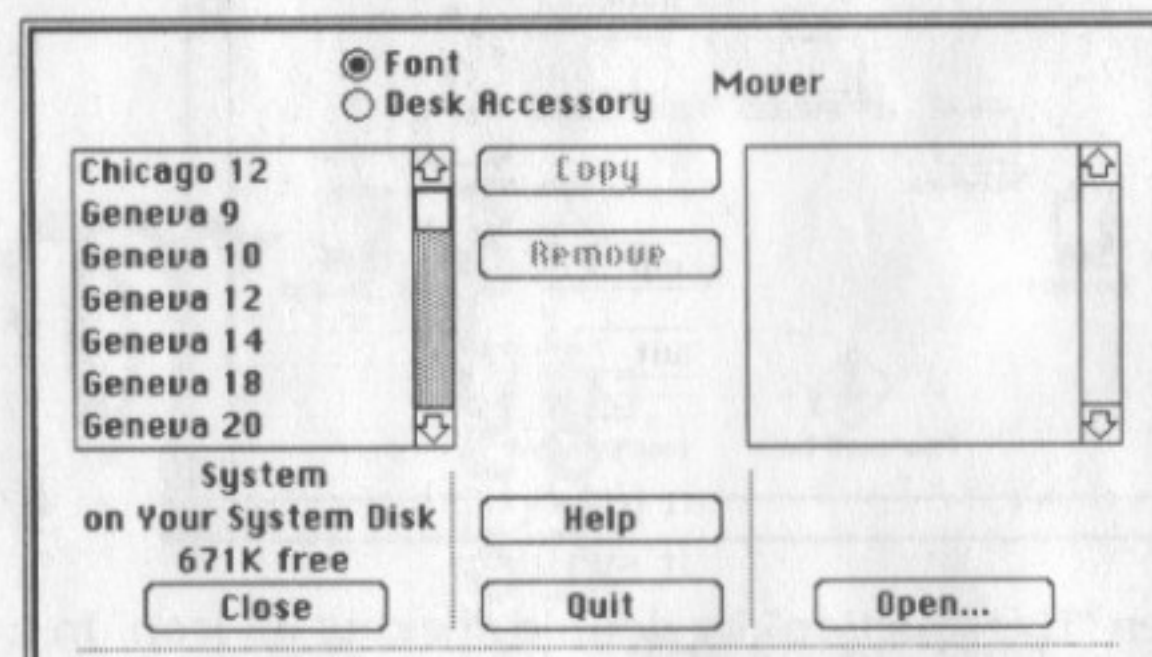
Read these two pages only if you want to use *Letterforms & Illusion* with a paint program other than MacPaint Demo (which is included on the *Letterforms* disk).

- If your computer is a Macintosh Plus, SE, II, or other recent model, you may skip this step and go on to Step 2. If your computer is not one of these models but has an 800K disk drive, go on to Step 2.
- If your computer is a Macintosh 128 or 512 without an external 800K disk drive, then your Macintosh can only read single-sided (400K) disks. *Letterforms & Illusion* comes on a double-sided (800K) disk. You need to copy the *Letterforms* software onto 400K disks before you can use it. Please read on.
- To copy the software onto 400K disks, you will need three blank disks, your own copy of MacPaint (version 1.5 or earlier), a system disk (any disk that includes a System Folder) and a Macintosh with an 800K drive.
- Turn on your Macintosh. Insert each blank disk in the 800K drive and initialize it as single-sided. (An 800K drive can initialize both 400K and 800K disks.)
- Copy 1. Open Me First, Tutorial, Flips and Fonts from the *Letterforms & Illusion* disk onto the first disk, and label it *Letterforms Part 1*.
- Copy Kits, 62. The End and Font/DA Mover from the *Letterforms & Illusion* disk onto the second disk, and label it *Letterforms Part 2*. Do not copy MacPaint Demo.
- Copy the System Folder from one of your disks and your copy of MacPaint (version 1.5 or earlier) onto the third disk, and label it *Letterforms System Disk*. Please use this system disk throughout Steps 2, 3, and 4.

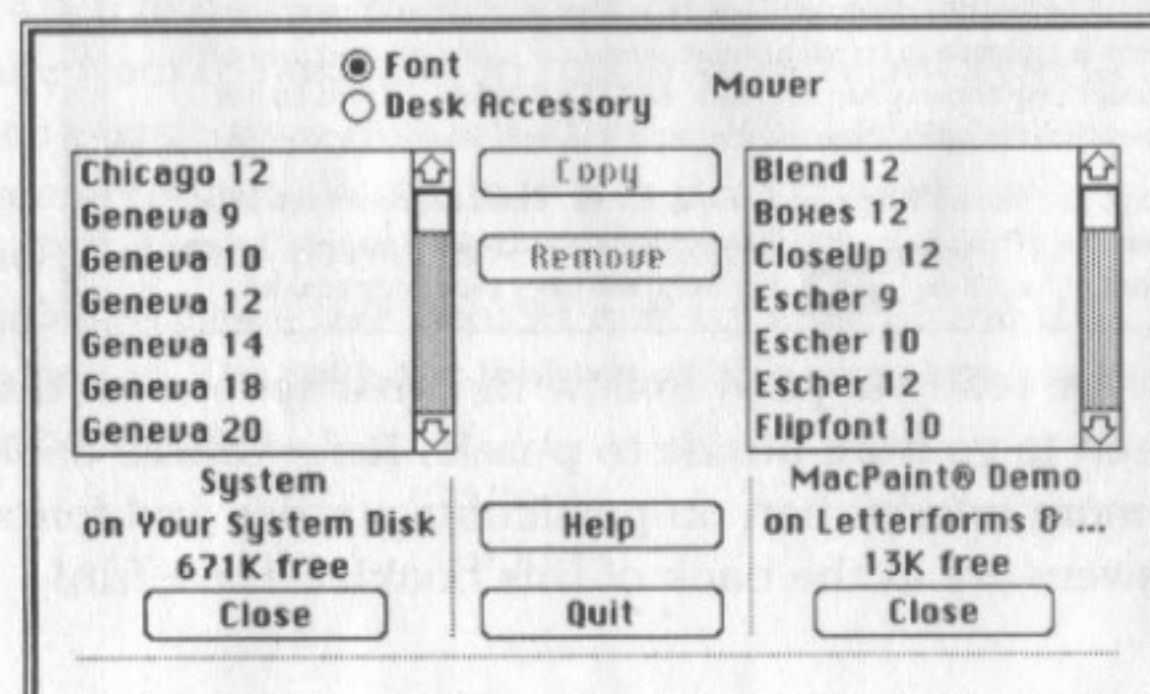
Step 2. Moving the Fonts to Your System

Next, you will copy the *Letterforms* fonts and desk accessory from MacPaint Demo to your system disk, by using an application called the *Font/DA Mover*.

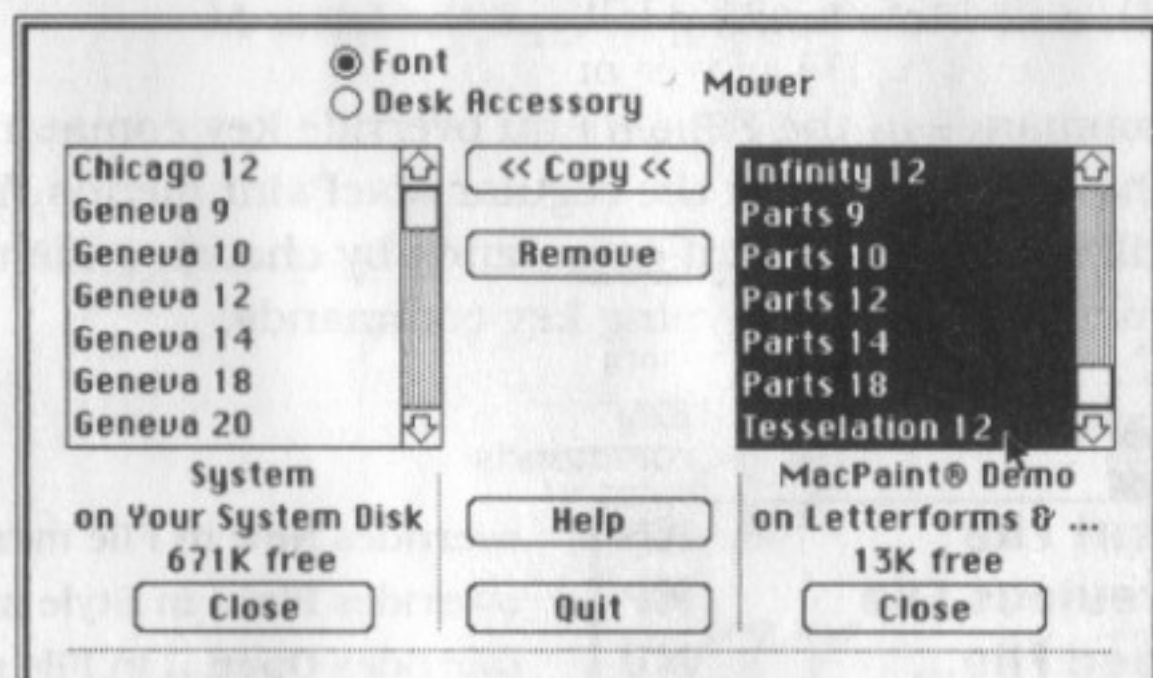
- Turn on your Macintosh. Insert a system disk. Insert the *Letterforms & Illusion* disk (or *Letterforms Part 1*). Open the Font/DA Mover on the *Letterforms* disk. You will see a window with two fields. The left field lists fonts in your system:



- Press and hold the Option key, and while holding it, click on the Open button beneath the right field. Keep holding the Option key until the dialog box for opening a file appears, then release the Option key. Select MacPaint Demo and click on the Open button. You will see a list of the *Letterforms* fonts in the right field:



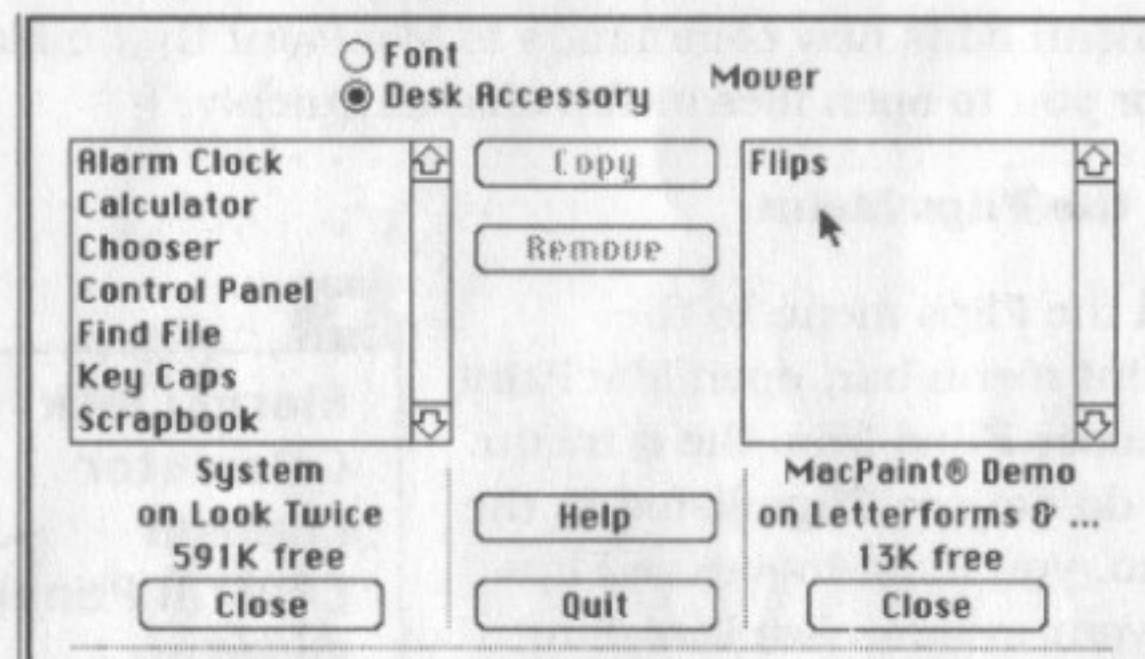
- Select the entire list of *Letterforms* fonts by moving the cursor to the first font name (Blend), pressing and holding the mouse button, and dragging down past the bottom of the list. The field will automatically scroll up, selecting all fonts (ending with Tessellation):



- Click on the Copy button to copy all the fonts from MacPaint Demo into your system.
- You need at least 80K of space available on your system disk to hold the fonts. If there is not enough space, you need to make more space by throwing away unnecessary files from the System Folder on your system disk to make more space. The only files you must keep are System and Finder (and, to print, ImageWriter, or LaserWrite and LaserWriter Prep). For safety, be sure to make a copy of your system disk before removing any files.
- If there is still not enough space, use the Font/DA Mover to remove extra fonts and desk accessories from your system. Open the Font/DA Mover, select fonts you want to remove, and click on the Remove button. (The Font/DA Mover will not let you remove system fonts Chicago 12, Geneva 9, Geneva 12, or Monaco 9.) Then copy the *Letterforms* fonts to your system disk.

Step 3. Moving the Desk Accessory to Your System

- With the Font/DA Mover open, click on the Desk Accessory button at the top of the window. You will see desk accessories in your system listed in the left field.
- Press and hold the Option key, and while holding it, click on the Open button beneath the right field. Select MacPaint Demo and click on the Open button. You will see Flips in the right window:



- Select Flips and click on the Copy button. If there is not at least 19K of space available, make more space on your system disk before copying Flips. Click on the Quit button to quit the Font/DA Mover.

Step 4. Opening the Paint Program

- Start up your Macintosh with the newly modified system disk. Insert the disk containing the paint program you want to use. Open the paint program by double-clicking its icon. Check the Font menu for the *Letterforms* fonts, and the Apple menu for Flips. If they are not there, try Steps 2 and 3 again.
- Open 1. Introduction from the *Letterforms* disk. Follow the instructions on the screen to go from puzzle to puzzle. Whenever MacPaint asks you "Save changes before closing?" respond by clicking on the No button, so the files on the disk remain unchanged.



Flips

About Flips

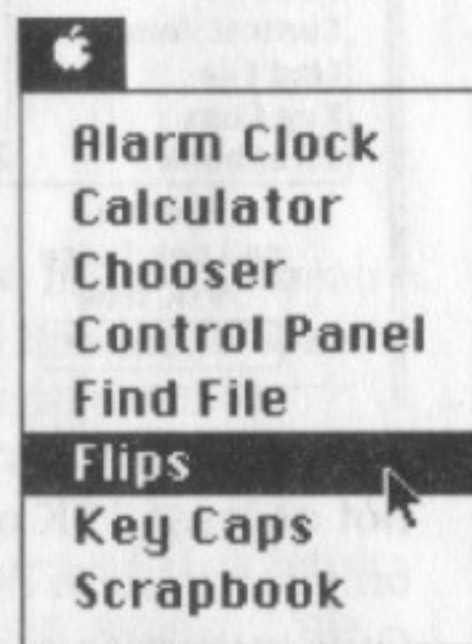
Flips is a folder on the disk. It contains puzzles that challenge you to flip shapes in your imagination. Before you try the Flips puzzles, please read through the files in the Tutorial folder, which explain everything you need to know about MacPaint to use the puzzles.

To solve the Flips puzzles you will use a special menu called *Flips*, which comes with *Letterforms & Illusion*. The Flips menu adds new commands to MacPaint that make it easy for you to open files or flip shapes quickly.

About the Flips Menu

To add the Flips menu to the MacPaint menu bar, open MacPaint and choose **Flips** from the  menu. (If you do not see **Flips** listed in the  menu, you must move the Flips DA to your system. See Installing the Paint Program on page 12 of this booklet for instructions.) The Flips menu will appear at the right end of the MacPaint menu bar.








By the way, you can use Flips with any MacPaint file, not just the ones in *Letterforms & Illusion*. Just be sure to add the Flips menu to the MacPaint menu bar before using it. The **Next File** command opens whatever MacPaint files you have on your disk in alphabetical order.



Key Commands

Most of the commands in the Flips menu have equivalent key commands which you can type from the keyboard. Key commands are listed in the Flips menu to the right of the command names. For instance, the key command for **Next File** is ⌘N . To use it, press and hold the Command key (⌘), and while holding it, type the letter N.

Key commands in the Flips menu override key commands with the same names in the regular MacPaint menus. You can still use the MacPaint commands by choosing them from menus instead of typing key commands.

Flips		Key commands
Next File	⌘N	overrides New in File menu
Previous File	⌘P	overrides Plain in Style menu
Open File...	⌘O	overrides Open... in File menu
<hr/>		
 Flip Horizontal	⌘1	— override commands in Goodies menu for switching windows
 Flip Vertical	⌘2	
 Rotate Left 90°	⌘3	
 Rotate Right 90°	⌘4	
 Rotate 180°	⌘5	
 Flip Left Diagonal	⌘6	
 Flip Right Diagonal	⌘7	
<hr/>		
Smaller Font Size	⌘<	
Larger Font Size	⌘>	
About Flips...		
<hr/>		
Quit Flips		

Flips are Visual Thinking

If you have ever solved a puzzle strictly in your head you may have already mastered some of the flips you will find in the Flips. We use the word *flips* to describe all seven symmetry operations in the Flips menu. The picture below illustrates the different operations.

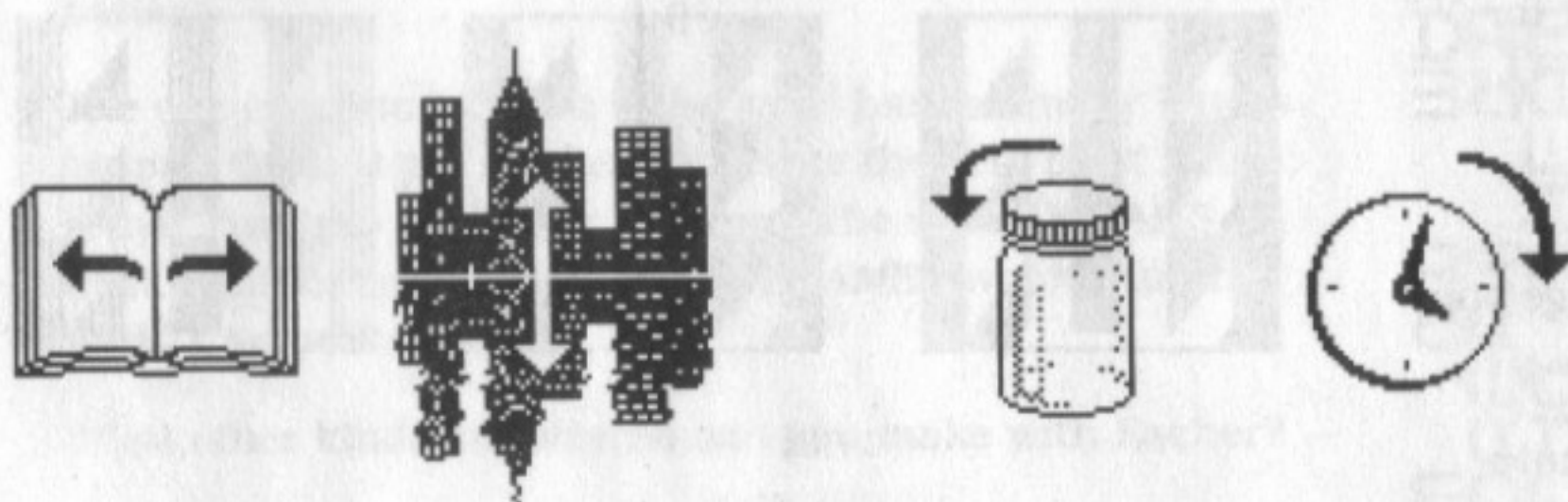
Spatial transformations, mental rotation, visual thinking skills, and puzzles in your head are some of the ways people describe the puzzles you will see in the software. The puzzles challenge your skill to do such things as **Flip Horizontal**, **Flip Vertical**, **Rotate Left**, **Rotate Right**, **Flip Left Diagonal**, and **Flip Right Diagonal**. The Flips menu includes these flips, each with its own key command.

Invitation to a Challenge

As you go through the puzzles, see if you can imagine the outcome of each flip before you see it. You will find that your ability to visualize flips will improve as you work your way through the disk.

word eye

Can you imagine, for example, what this design would look like if you held it up to a mirror? You may find it helpful to gesture the flips with your hands.



⌘1
Flip Horizontal **Flip Vertical**

⌘3
Rotate Left **Rotate Right**

Fonts

Fonts as Puzzles

Have you ever used a font to solve a puzzle? The *Letterforms* disk contains ten fonts designed especially for solving puzzles and making designs.



The Fonts folder on the disk contains puzzles based on the fonts. Each font has its own folder of puzzles, except for Edmond, which has no puzzles.

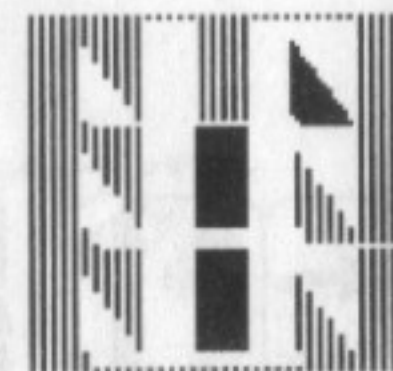
The first puzzle of each folder invites you to type your name and try experiments that demonstrate special features of the font. The subsequent puzzles challenge you to solve puzzles with the font.

Some of the fonts are highly symmetrical. Others create interesting visual illusions. Escher has letters that can rotate and be read as other letters. You can even type inversions using the Infinity font. See the following pages of this booklet for examples of designs you can make with each font.

Fonts as Design Elements

Besides solving puzzles with the fonts, you can make designs. MacPaint gives you many tools for modifying letterforms, such as Fat Bits, Invert, and Trace Edges. See your MacPaint manual for tips on using the tools.

The Close-up font is an especially interesting starting point for making designs. Can you see which part of the name *Robin* was stacked in the picture below? You can see other examples of font designs in the following pages.



Font Characteristics

The *Letterforms* fonts have a few unusual characteristics that are important for you to know about.

- The font size listed in the Style menu does not reflect the actual size of the font on the screen. If you type a word in “12-point” Edmond and change the font to Illusion you will see that “12-point” Illusion is gigantic while “12-point” Edmond is tiny. Properly, 12-point Illusion should be listed as a 72-point font. But if fonts were labeled according to their true sizes you would have to keep changing font sizes as you changed fonts. To minimize font size changes, we list the basic version of every font as 12 point.
- Changing font size in the Style menu will not always change the size of the letters. Sometimes changing font size will give you another variation of the font with letters of the same size. For instance, “14-point” Edmond is a bold version of “12-point” Edmond, while “10-point” Parts is the upper half of “12-point” Parts.
- Most of the *Letterforms* fonts take advantage of MacPaint's Grid feature. For instance, Close-up letters match the grid spacing in both height and width. Keep Grid turned on to make letters easier to copy and flip. Turn Grid off when you want finer control.
- The *Letterforms* fonts are bitmapped fonts designed for display on the screen or for printing on the ImageWriter. You can print them on the LaserWriter, but they will look jagged. For best results on the LaserWriter, type your message in a paint program. Then print the message directly from the paint program, or copy the message and paste it into another program such as a word processor. Using the fonts directly in your word processor will give strange results.

An Infinite Number of Puzzles

Most puzzles present challenges that you solve once then put aside. This is not the case with the *Letterforms* puzzles. Once you have solved a puzzle, you can make a new one by using the font to fill in new pieces.

Make each of these designs by typing just two letters. Do not hold the Shift key. Use the Spacebar to advance, and the Delete key to erase.

V O X I M H W X E

TYPE
HERE

ABCDEFGHIJKLM
NOPQRSTUVWXYZ

Answers: page 42.

Type **EN** for next file.

In the Blend puzzle above, for instance, you can type two new letters in the Blend font and create a new form to decipher. Since you have the whole alphabet to choose from, there are many possible combinations.

You can do many creative things with the fonts in *Letterforms*. We hope you do go on to create your own puzzles. We would love to see your puzzles and designs. You can write to us at Look Twice, P.O. Box 50697, Palo Alto, CA 94303.

illusion

Illusion can perform many tricks. The font is based on a pattern of evenly spaced black and white stripes.

Every stripe, white or black, is exactly four pixels (screen dots) wide. This means all strokes will match when you can splice the top half of one word onto the bottom half of another word.

Characteristics

- Horizontal spacing matches Grid
- Made of evenly spaced black and white stripes

12 point

abcdefghijklm
nopqrstuvwxyz
'1234567890-[]\;',./

+ Shift

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
~!@#\$%^&*0_+{}|:~>?



Using Illusion

Try shifting parts of words horizontally. Good places to slice words are about a quarter of the way from the top and bottom.

Here's an unusual optical effect. Turn off Grid, select a slice of the word, shift it four pixels left or right, and Invert.

To stretch a word, turn off Grid, select a slice of the word, hold the Shift, Option, and Command keys with one hand, and drag the slice straight down with the other hand. This will smear the edge of the slice like dragging a comb through sand. Drag slowly so the stretch will be smooth. What other tricks can you invent?

Illusion can get you started making inversions. Copy the top of a word, flip it, and join it to itself. You will rarely get a perfect inversion, but you will often come close enough to suggest how an inversion might be completed.

→ earthquake earthquake

← earthquake earthquake

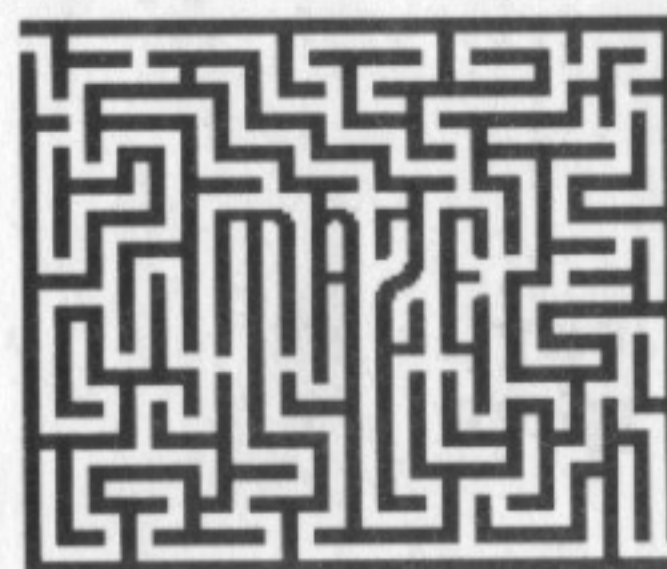
stretch identical black

tim → tim henry → henry

mother

circle

waterfall



Flipfont

Flipfont is more fun to use than to read about. Try it! Set up Flipfont and ask an unsuspecting friend to type something while watching the screen. Flipfont is the same as the Edmond font, except that letters are flipped.

Characteristics

- Same letter shapes as Edmond
- Different font sizes flip letters different ways

12 point zyxwvutrqponmlkjihgfedcba
 / \ , ; [] = - 0 9 8 7 6 5 4 3 2 1
+ Shift ZYXWVUTSRQPONMLKJIHGFEDCBA
 ~ ! @ # \$ % ^ & * (_ + } { " ' < > |

10 point This is a sample of 10-point Flipfont.

12 point This is a sample of 12-point Flipfont.

14 point This is a sample of 14-point Flipfont.

18 point This is a sample of 18-point Flipfont.

Help, I'm trapped inside a Mac!

Dr. Jekyll
Mr. Hyde

....
(o) (o)
L
' '

0000000000
<<<<<<<<<<<<
PpPpPpPpPp
\\ \\ \\ \\ \\ \\ \\ \\

Using Flipfont

Which letters stay the same when you change between 10- and 12-point Flipfont? Between 12- and 14-point? Between 14- and 18-point?

Try typing the sentences at right just as they appear, starting with what would normally be the final punctuation mark. Before typing, change the font size to 12 point and the style to Align Right.

A palindrome is a word or sentence that is spelled the same forward and backward. Try typing the palindromes at right. What happens when you change between 10 and 12 point? Be sure to rest your brain after trying these.

This font is all backwards.
This font is all backwards.
This font is all backwards.
This font is all backwards.

This font is all backwards.
The quick brown fox jumps over a lazy dog.
'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,

level
TACECAL
OTTO
TOOH OT TOH OOT
ABLE WAS IERE I SAW ELBA

emipidextromz

What goes up wnat come down

Push me - you - em hznf

Four letters in
this sentence
are facing the
wrong way.

Book ends
boooooook
boooooook
boooooook
boooooook
boooooook
boooooook
boooooook
boooooook
boooooook
boooooook

Close-up

Close-up is a font for making patterns. Only a small square portion of each letter is visible. Because most of each letter is missing, the overall effect is more of texture than of text.

Characteristics

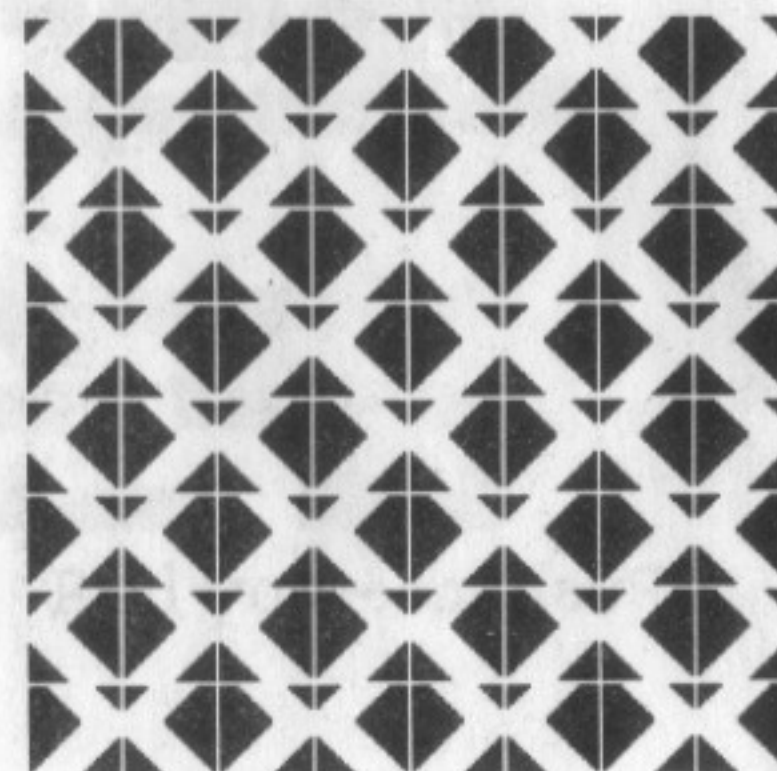
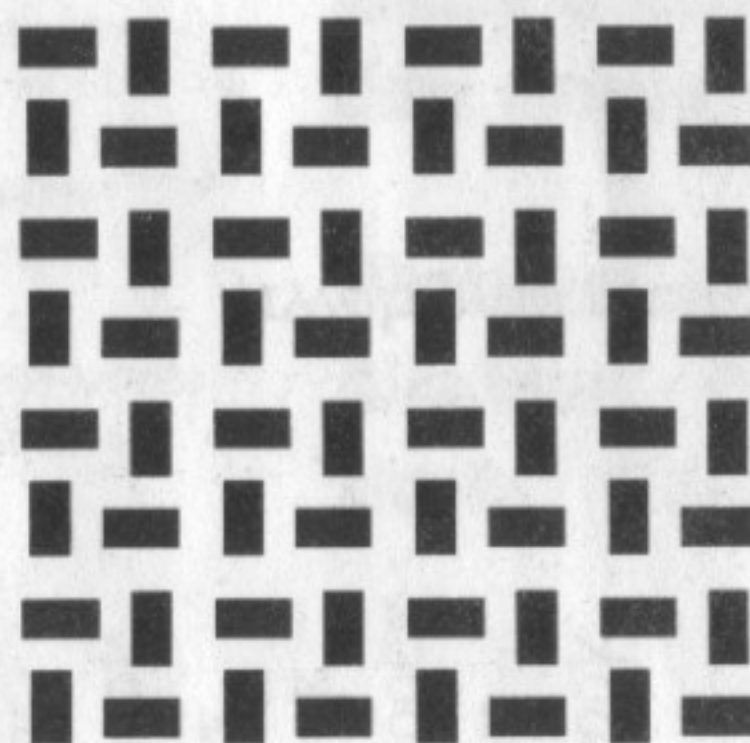
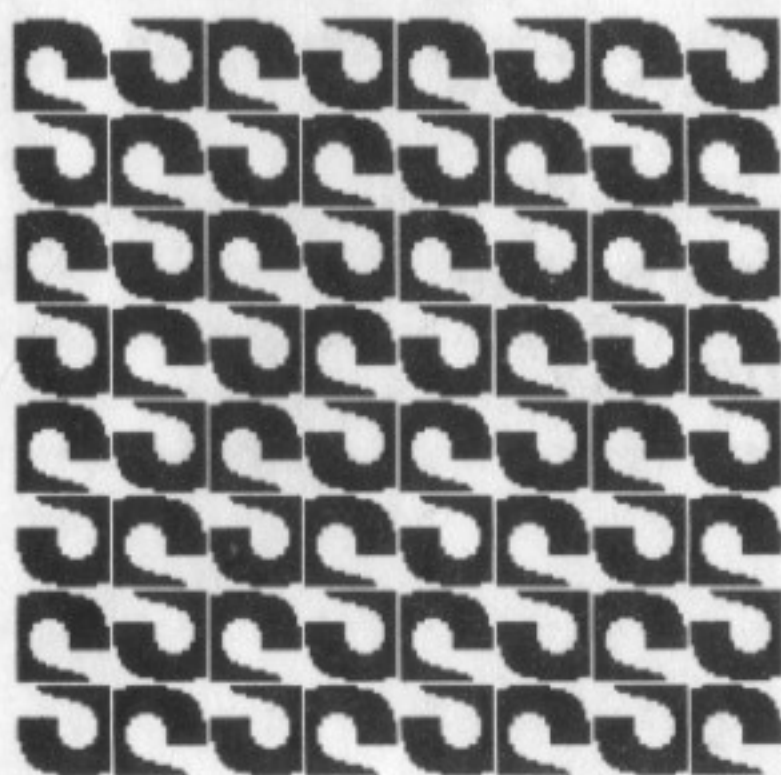
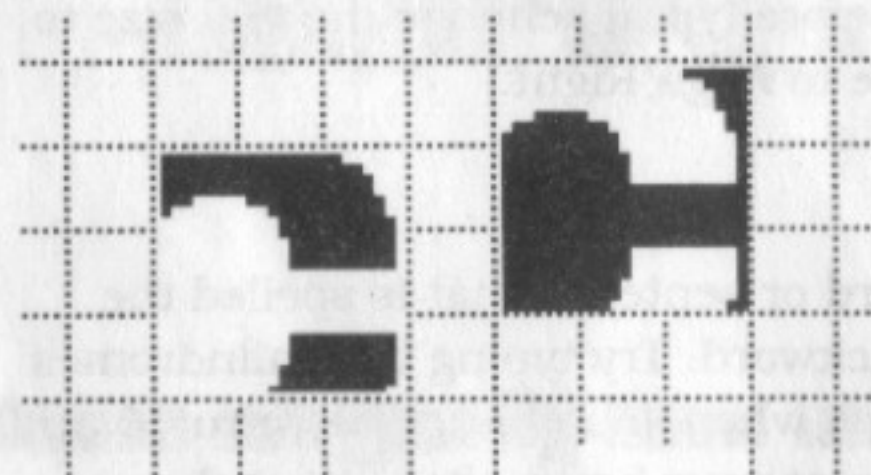
- Horizontal and vertical dimensions match Grid
- Square proportions

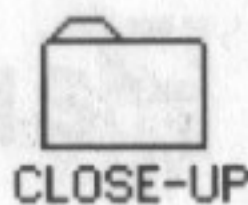
12 point

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z

+ Shift

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z





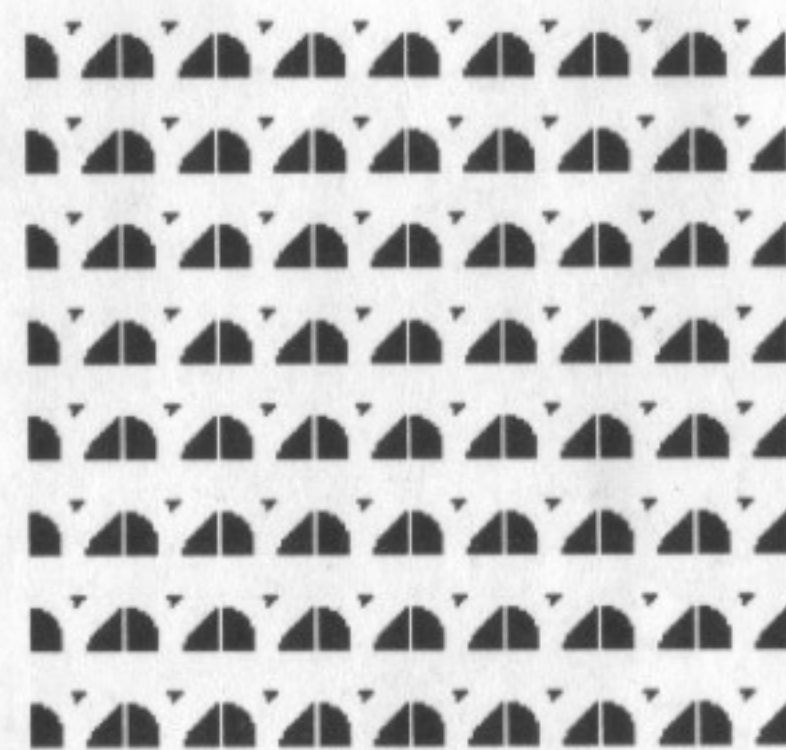
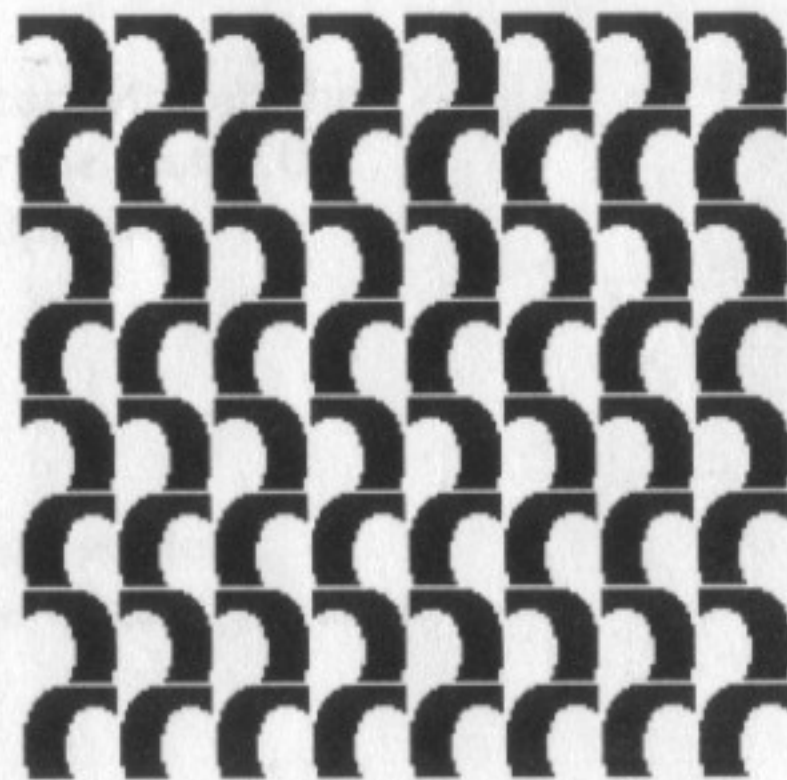
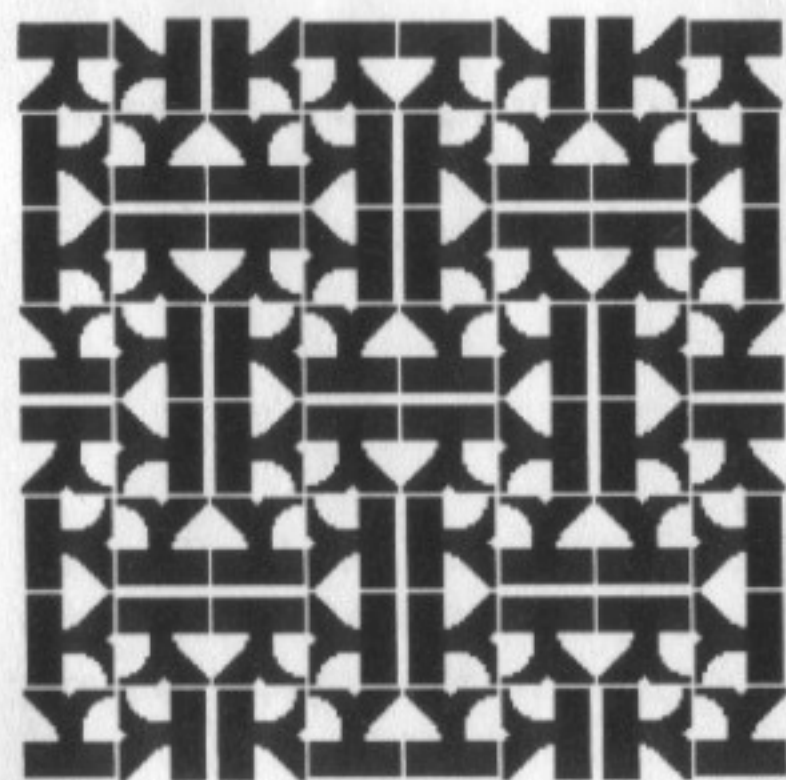
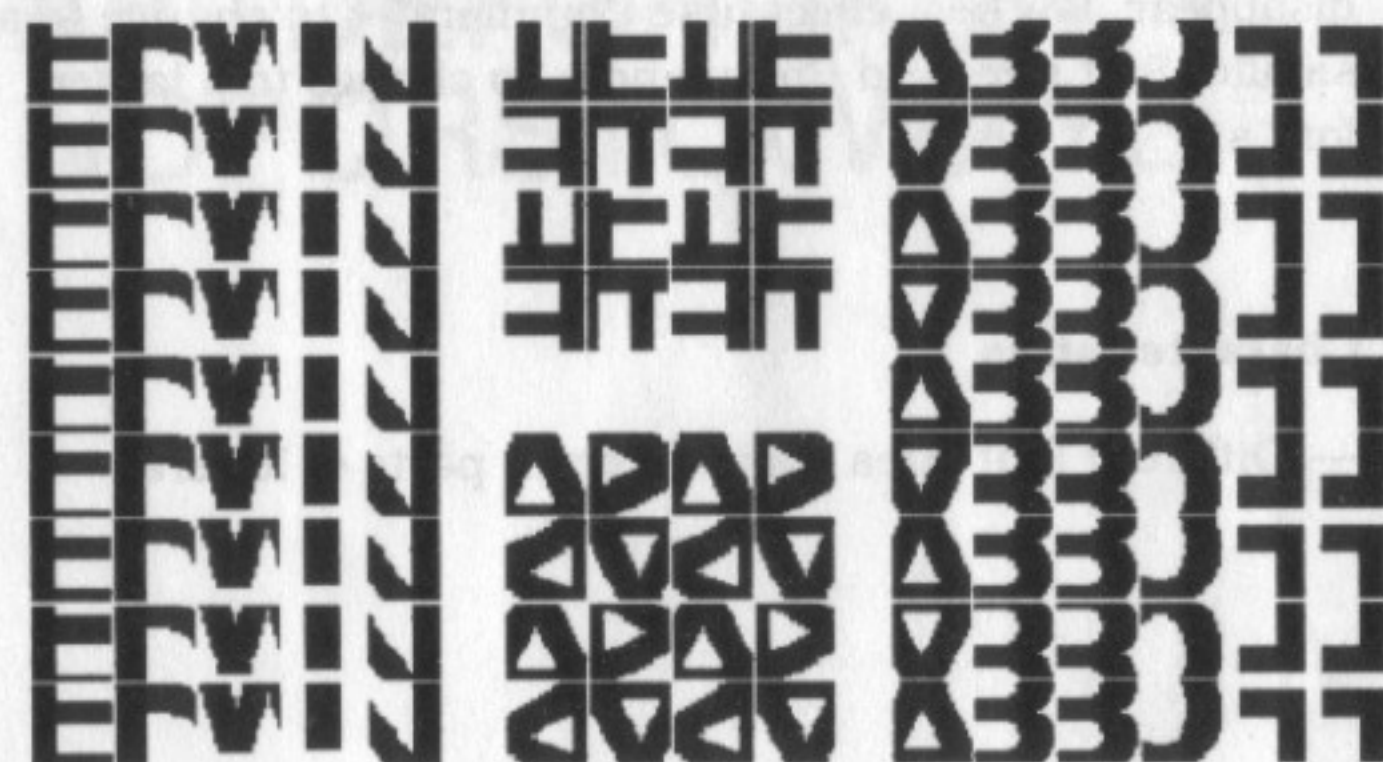
Using Close-up

Type your name. Try typing both with Shift and without Shift. Try mixtures of both. Which is easier to read?

Keep Grid on to make it easy to select letters with the selection rectangle and to make it easy to reposition letters.

Copy, flip, and rotate letters to make repeating patterns. See how many different patterns you can make with the same letters.

Substitute different letters into the same pattern and see how the effect changes.



Parts

Parts is a font for exploring the shapes that make up letters. Each font size shows a different kind of letter part.

12 point all parts

14 point straight strokes

18 point curved strokes

As you change font size, different parts will appear or disappear. For best effect, use Command-< to change to a smaller font size, and Command-> to change to a larger font size.

Characteristics

— Different font sizes show different parts of letters

12 point **abcdefghijklm
nopqrstuvwxyz
'1234567890-=[];',.^**

+ Shift **ABCDEFGHIJKLM
NOPQRSTUVWXYZ
~!@#\$%^&*()_+{}:"<>?|**

12 point **provocative RATIOS**

14 point **| I V itiv- RATI**

18 point **o'o oca. c ' OS**

Playing with Parts on Paper

Which is easier to read, the upper half of a word or the lower half? Cover up the upper and lower halves of the words at right and see for yourself.

Which of the letters at right has only straight parts? Only curved parts? Only diagonal parts? What words can you make using only one kind of part? Draw your own fonts using only one kind of letter part, for instance, all straight lines.

Print your name in capital letters, letting the pen or pencil touch the paper only during straight strokes. Try it again with only curved strokes.

Draw an A, leaving out as much as you can without the letter becoming illegible. Do the same for the rest of the alphabet. Write words in your minimal alphabet.

Draw a pattern of disconnected horizontal, vertical, diagonal, and curved lines that looks like writing but isn't. Graphic designers call this "greeking".

which half reads

ABCDEFGHIJKLM
NOPQRSTUVWXYZ

Blend

Blend is a font for creating puzzles. When you type, letters pile up on top of each other in the same place instead of appearing side by side. The cursor doesn't advance until you type a space. Blend includes both positive (black on white) and negative (white on black) letters.

Characteristics

- Letters pile up in the same place when you type
- Upper case only
- Spacebar advances cursor
- Shift reverses black and white

Using Blend

Pairs of letters create interesting puzzles. Can you see which pairs of letters created each of the designs at right? To solve such puzzles, you must visualize which letters share which parts. Check your answers on page 40.

Negative letters make harder puzzles. Can you see which pairs of letters created each of the designs at right? Reversed letters act like holes cut in black cardboard. Only the common white areas show through both layers.

Positive and negative letters make yet another sort of puzzle. To solve such puzzles, imagine which letter contains all the white areas. Then imagine which letter blocks the missing areas.

Can you read the two five-letter words superimposed at right? Hint: the two words have opposite meanings. You might want to try typing your first name on top of your last name, or superimposing other pairs of words.

12 point

A	B	C	D	E	F	G	H	I
J	K	L	M	N	O	P	Q	R
S	T	U	V	W	X	Y	Z	

+ Shift

A	B	C	D	E	F	G	H	I
J	K	L	M	N	O	P	Q	R
S	T	U	V	W	X	Y	Z	

S X B M A

E V F H F

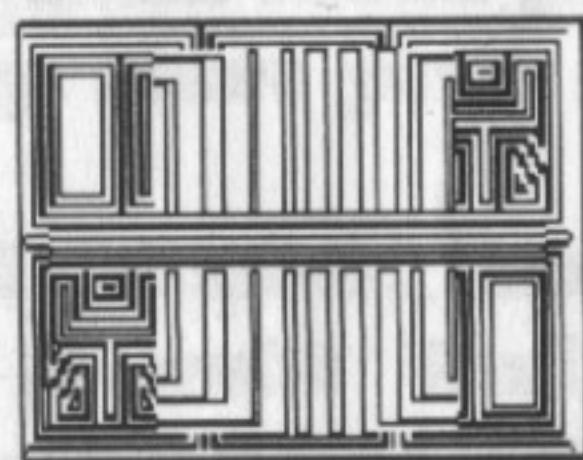
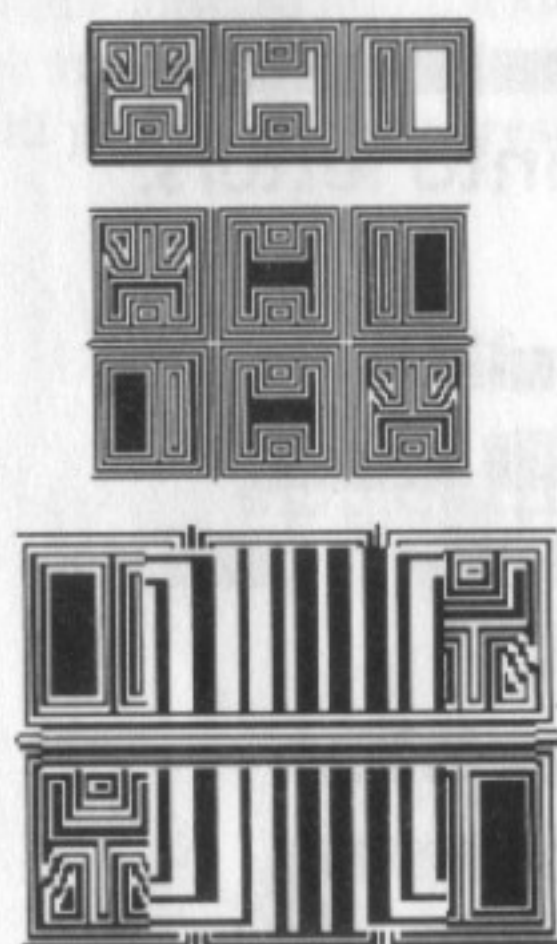
S Y K H I

W H A C E

Making Designs with Blend

At the right are some pairs of letters typed in Blend. Can you tell which of these letterforms were used to make each of the designs below?

Blend can be used as a starting point for designing monograms, logos, or symbols. Try playing with Blend and see if you can design a monogram of your initials.



Boxes

Boxes is a font for typing cryptic messages. Each letter in Boxes is reduced to a black box that is the height and width of the letter.

Characteristics

— Letters have same heights and widths as Parts letters

Using Boxes

The Boxes font was made by covering each letter in the Parts font with a black rectangle. Type a message in Boxes, then change the font to Parts. You will see the boxes magically turn into letters.

Can you decipher the common sayings at right? Hint: look for letters with distinctive shapes, such as *i*, *t*, and *m*. What other letters have distinctive shapes? Check your answers on page 40.

Here is a game to play with a friend. Choose a familiar category, like names of local cities or people you both know. Take turns typing words and letting the other person try to read what was typed. For instance, the words at right were typed by someone who chose font names as the category.

12 point

Boxes
magically
turn into
letters.

+ Shift

All that glitters isn't gold.
Many words make light work.
The more words you use the better.

Boxes magically turn into letters.

All that glitters isn't gold.
Many words make light work.
The more words you use the better.

Font names
are the
category.

What Boxes Tells Us About Legibility

Both of the sentences at right say "All that glitters isn't gold." The first is typed in lower-case Boxes (with initial capital) and the second in upper-case Boxes. The first sentence is easier to read because the varying heights of lower-case letters give words distinctive shapes. When we read, we look for these shapes to help us identify words quickly. That is why lower-case print is easier to read than upper-case print.

All that glitters isn't gold.
ALL THAT GLITTERS ISN'T GOLD.

tessellation

A *tessellation* is a pattern made of many copies of a single shape that fit together like pieces of a jigsaw puzzle, without any overlaps or holes. Every letter in the Tessellation font can make a tessellation. Try stacking and interlocking letters, and see what designs you can make.

Characteristics

- Lower case only
- Made entirely of squares one grid unit in size
- Every letter can make a tessellation

Using Tessellation

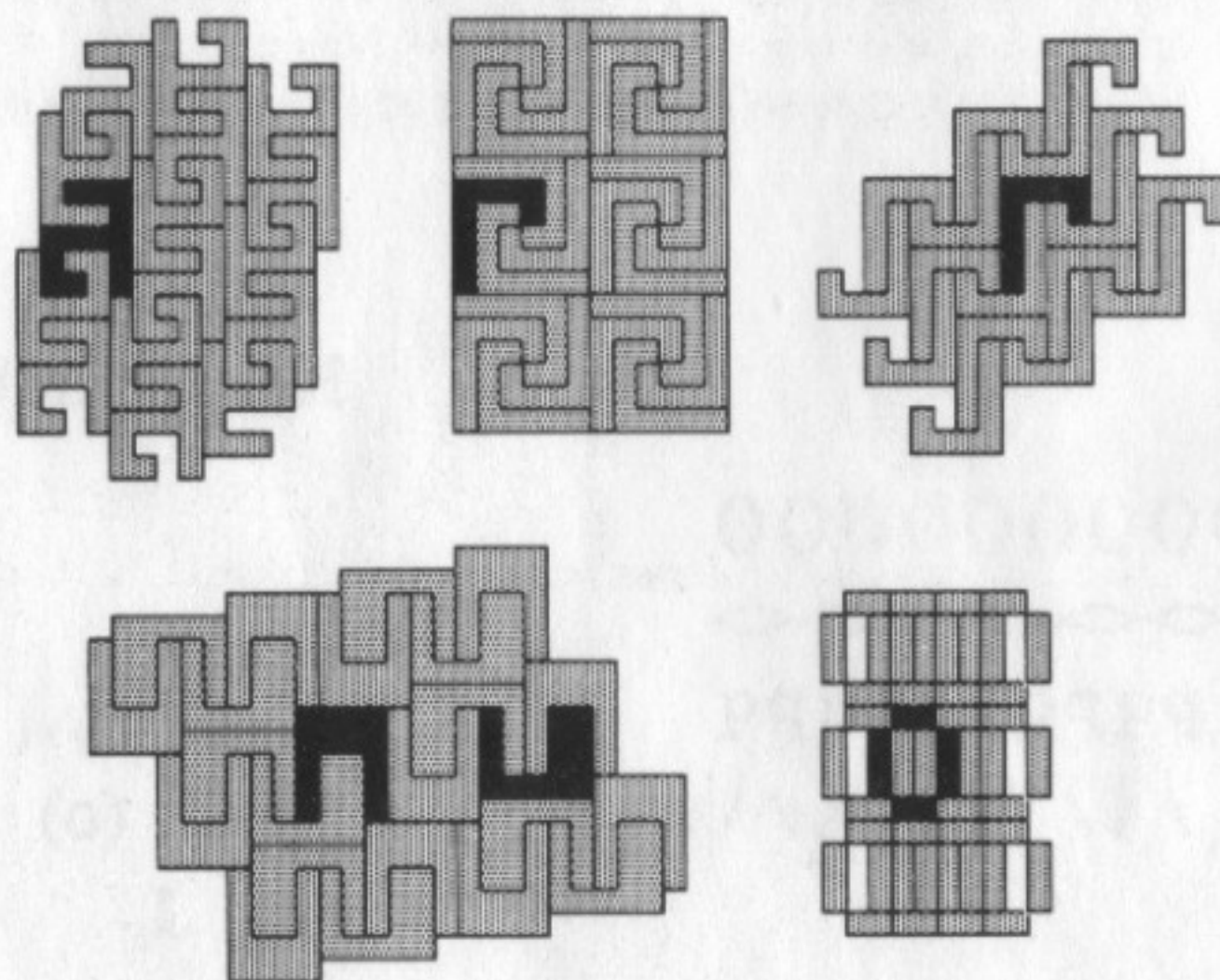
Tessellation is a great font for exercising the flips. Start with any letter. Make a copy. Can you flip the copy and fit the two letters together? Can you continue copying and flipping to make a pattern that fills the screen without any overlaps or holes? Use the paint bucket to fill letters with textures and bring out different patterns.

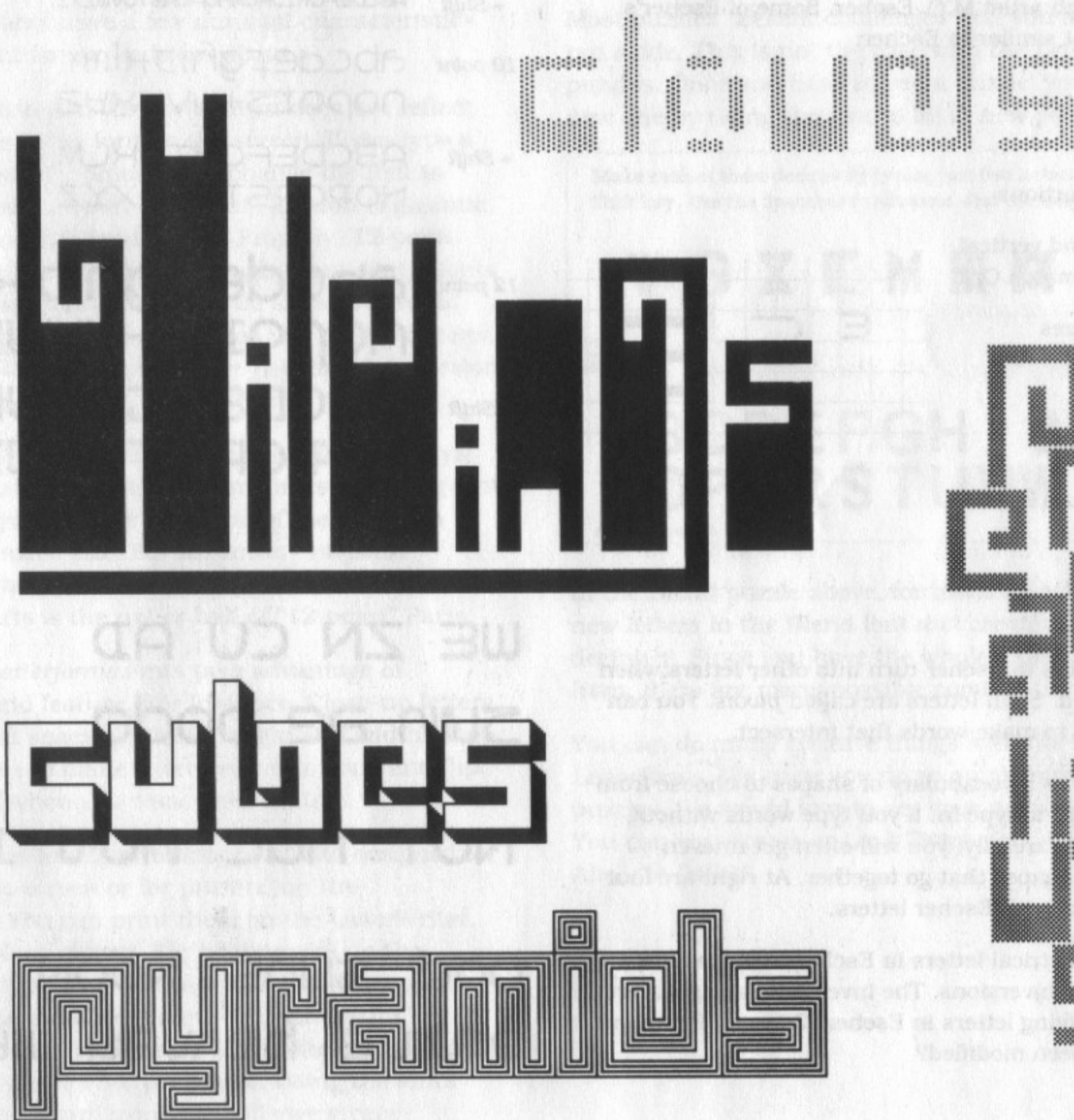
See if you can discover how each letter in Tessellation tessellates with itself. Some letters, like *r*, tessellate in more than one way. You can also make tessellations that use several letters, like *n* and *c*. Note: some letters, like *o*, cross over themselves at corners.

For a harder challenge, try designing your own tessellating letters. Use the line tool with Grid turned on to draw the outlines, then use the paint bucket to fill the interiors. Can you invent upper-case letters that tessellate?

12 point

a b c d e f g h i
j k l m n o p q r
s t u v w x y z



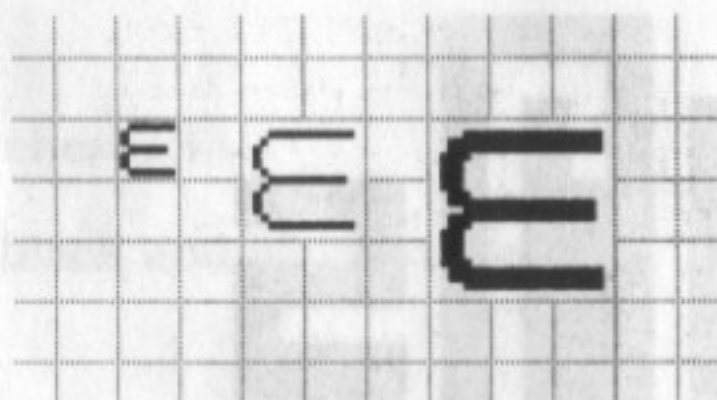


Escher

The Escher font was inspired by the intricate repeating patterns of Dutch artist M.C. Escher. Some of Escher's works use a font similar to Escher.

Characteristics

- Square proportions
- Horizontal and vertical dimensions match Grid
- Three font sizes



9 point abcdefghijklmnopqrstuvwxyz
+ Shift ABCDEFGHIJKLMNOPQRSTUVWXYZ

10 point abcdefghijklmnopqrstuvwxyz

+ Shift ABCDEFGHIJKLMNOPQRSTUVWXYZ

12 point abcdefghijklmnopqrstuvwxyz

+ Shift ABCDEFGHIJKLMNOPQRSTUVWXYZ

Using Escher

Many of the letters in Escher turn into other letters when rotated or flipped. Such letters are called *pivots*. You can use pivot letters to make words that intersect.

Think of Escher as a vocabulary of shapes to choose from rather than a font to type in. If you type words without choosing shapes carefully, you will often get uneven results. Choose shapes that go together. At right are four ways to make *nut* with Escher letters.

The highly symmetrical letters in Escher make excellent raw materials for inversions. The inversions at right were created by modifying letters in Escher. Can you figure out how they have been modified?

WE ZN CU AD U
sun ae pbdq O
CAT

NUT nut nʌt ɪʌt

pod suns NOON beg
əʊniə hʌvɪy wɪlɪjəm

Making Patterns with Escher

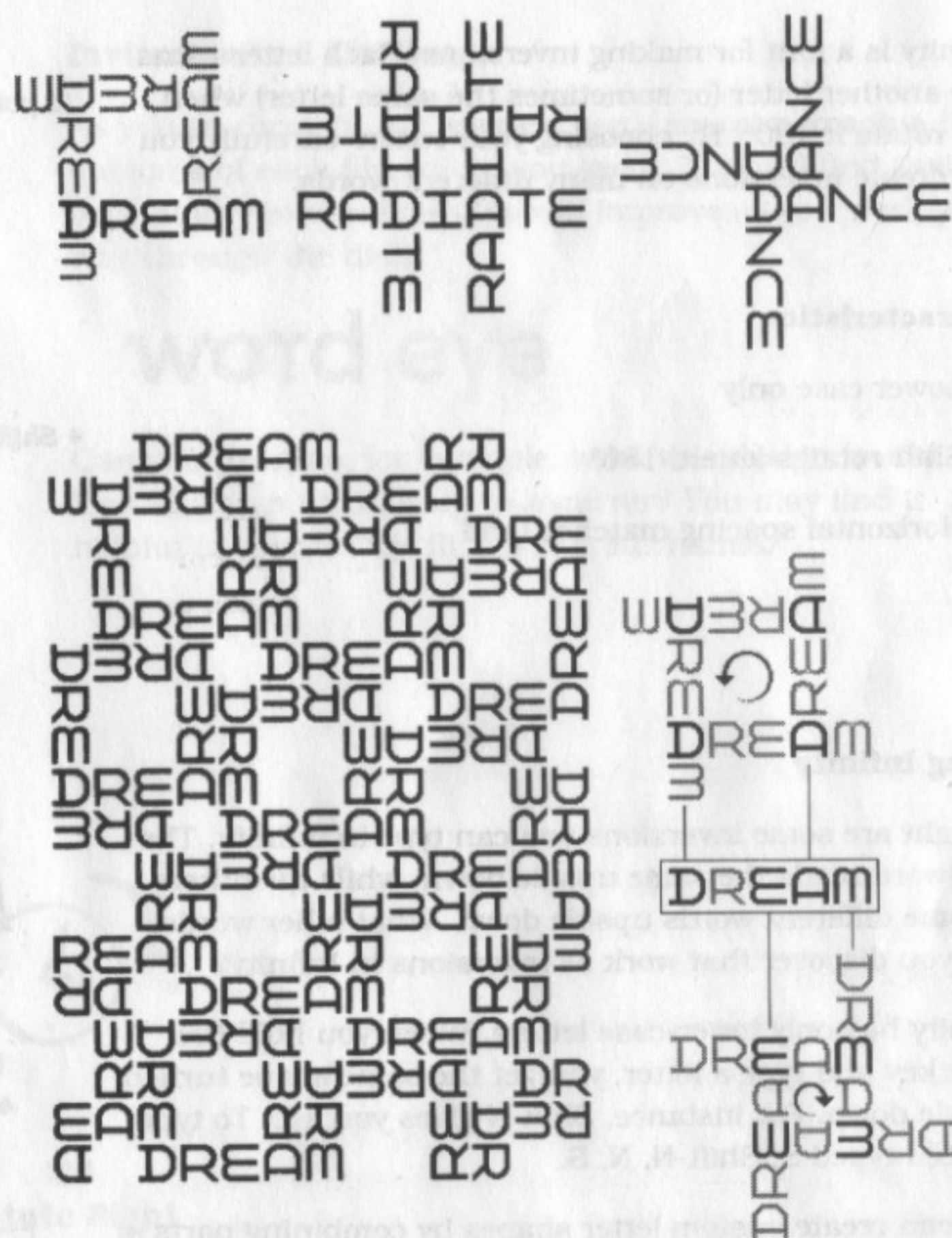
Patterns are Escher's forte. Here are pinwheels based on the words *DREAM*, *RADIATE*, and *DANCE*. These pinwheels work because the letter *D* can pivot to become *A*. Any word in which the same letter shape appears twice, once right side up and once rotated 90°, can make a pinwheel.

Here is a special type of pattern based on the word *DREAM*. Look closely and you will see the *DREAM* pinwheel repeated in the *DREAM* pattern. A second kind of pinwheel is based on *E* rotating to become *M*. Can you see it?

The *DREAM* pattern works because the *D/A* pinwheel and *E/M* pinwheels spin in opposite directions: *D* rotates left 90° to become *A*, while *E* rotates right 90° to become *M*. Almost any word that contains two different pairs of pivot letters that turn in opposite directions can make a pattern.

The one exception is that if the word has too many letters beyond the last pivot letter (or before the first pivot letter), it may run into itself. For instance, the word *DREAMS* could still make a pattern, but *DREAMER* would run into itself. Can you see how?

What other kinds of patterns can you make with Escher?



infinity

Infinity is a font for making inversions. Each letter turns into another letter (or sometimes the same letter) when you rotate it 180°. By choosing your letters carefully you can create inversions on many different words.

Characteristics

- Lower case only
- Shift rotates letters 180°
- Horizontal spacing matches Grid

Using Infinity

At right are some inversions you can type in Infinity. The first word reads the same upside down, while the others become different words upside down. What other words can you discover that work as inversions in Infinity?

Infinity has only lower-case letters. When you hold the Shift key and type a letter, you get the same shape turned upside down. For instance, Shift-N gives you a U. To type SUNS, I typed S, Shift-N, N, S.

You can create custom letter shapes by combining parts of letters. The best place to cut an Infinity letter apart is halfway up. For instance, you can combine top halves of the letters i, r, t, and l to create custom letters that read as one letter one way and another letter upside down. See the facing page for other custom letter shapes.

12 point

a b c d e f g h i j k l m
n o p q r s t u v w x y z

+ Shift

e a i a e f b y i l y l i a
u o d b r s t a i m x l z

big spider rest
suns

i r t l i r t l

Edmond

If you want to make your own puzzles in MacPaint, the Edmond font is for you. All instructions you see on the screen in *Letterforms & Illusion* were typed in Edmond. The instructions you see in this booklet were typed in a font called *Bookman*. Note: there are no puzzles on the disk for Edmond.

Characteristics

- Line spacing matches Grid
- Hold Option key for special characters

Using Edmond

Keep Grid turned on when you type. Grid makes it easier for you to position the cursor to retype a line, or to select a line of text to be moved. All screens in *Letterforms & Illusion* were typed with Grid on.

When you click to begin typing, you will notice that letters appear slightly lower than where you might expect. This adjustment was necessary to make letters fit entirely between grid lines.

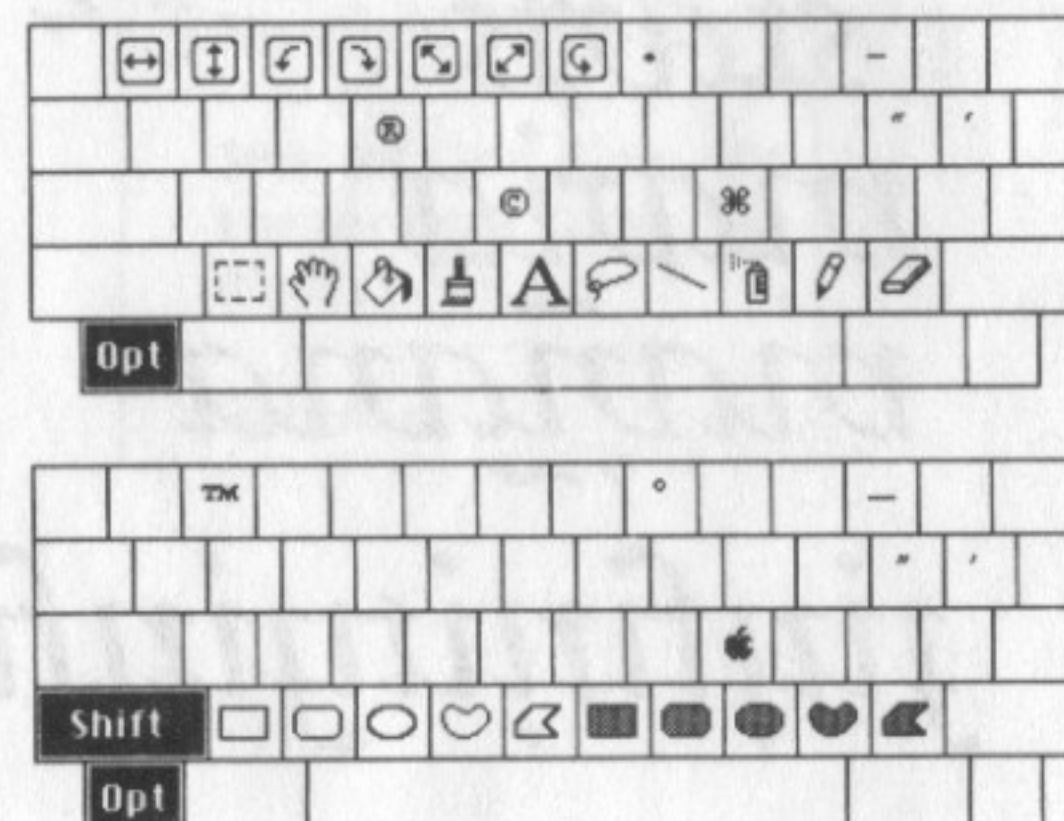
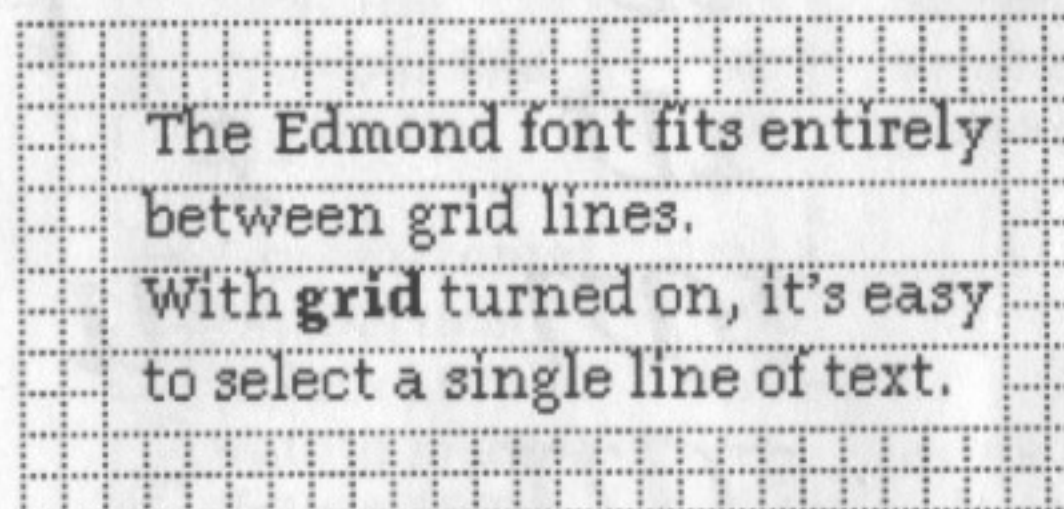
The 12-point version of Edmond includes special characters such as left and right double quotation marks, copyright sign, MacPaint tools, and flips icons. The diagrams at right show where the special keys are located. To type special characters, you will need to hold either the Option key or both the Shift and Option keys as you type.

10 point abcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZ
 `1234567890-=[]\;',./ ~!@#\$\$%^&*()_+{}|:"<>?

12 point abcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZ
 `1234567890-=[]\;',./ ~!@#\$\$%^&*()_+{}|:"<>?

14 point abcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZ
 `1234567890-=[]\;',./ ~!@#\$\$%^&*()_+{}|:"<>?

18 point abcdefghijklmnopqrstuvwxyz
 ABCDEFGHIJKLMNOPQRSTUVWXYZ
 `1234567890-=[]\;',./ ~!@#\$\$%^&*()_+{}|:"<>?



Making Your Own Puzzles

We created the *Letterforms* puzzles using just MacPaint and the *Letterforms* fonts. If you have your own paint program you can make and save your own puzzles.

An easy way to create a new puzzle is to copy one of ours and change it slightly. Can you make up your own letters to substitute into the puzzle below? How could you make the puzzle easier or harder? What if you allowed more than one flip? What if you used a smaller grid? What if there were shades of gray in addition to black and white? How else could you change the puzzle?

A good puzzle should have a clear goal (an example always helps), allow a range of approaches, and have a definite right answer. The reader should feel a satisfying sense of completion when the puzzle is solved. Most importantly, a puzzle should be fun. If it feels like a chore, it is a problem, not a puzzle.

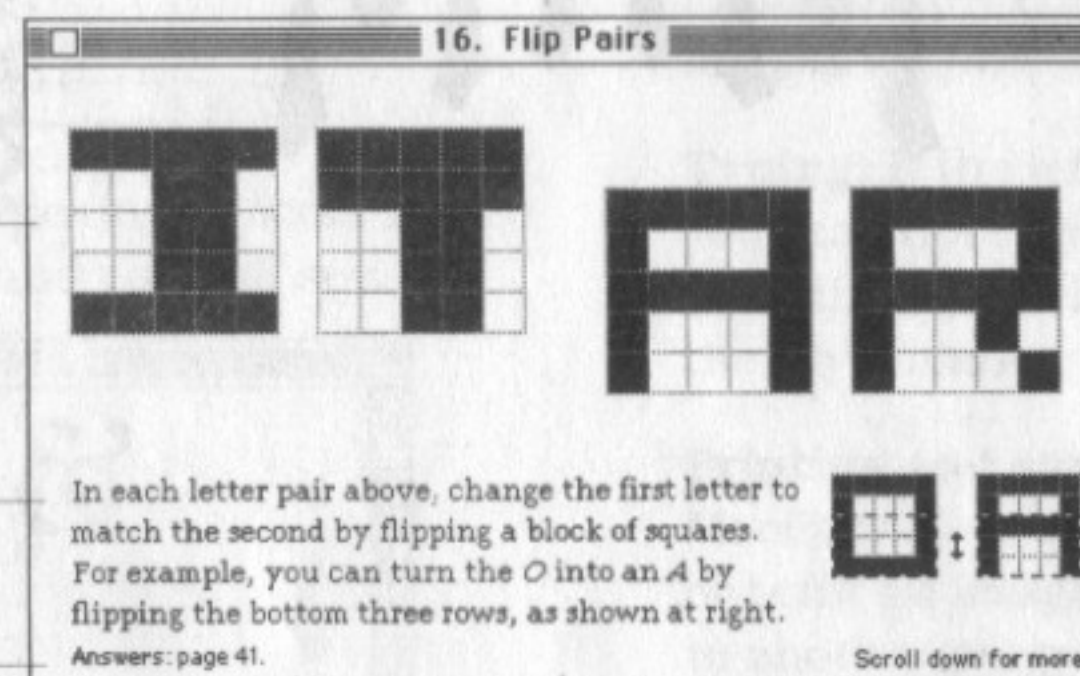
Be consistent about where you put different kinds of information on the screen, so the reader always knows where to look to find out what to do next. Below are some style guidelines we followed.

Use the middle of the screen for the puzzle itself. Leave adequate white space for the reader to work. Anything you want the user to select with the marquee should be enclosed in a dotted rectangle drawn with Grid turned on.

Keep instructions brief. MacPaint tools may be mentioned either by name or by icon. The first time a tool is mentioned, use both the name and icon, with the icon in parentheses.

In the lower left corner, tell the user where to find answers. Messages at the bottom of the screen are typed in 10-point Edmond.

Characters or words you type are in quotation marks. References to characters or words you see on the screen are in italic (14-point Edmond). Command names are in bold (18-point Edmond).



If a file contains more than one screen, separate adjacent screens with a dotted line the full width of the page. There is just enough room vertically for three screens per file.

Name your files alphabetically so the **Next File** command in the Flips menu will open them in the order you intend. **Next File** opens files in the order that they appear in the **Open File...** dialog box.

You may want to use spaces and numbers in labeling your files to force files to appear in the order you intend. For example, "Introduction" precedes "24 More Jigsaws" precedes "The End".

In the lower right corner, tell the user what to do next: either "Scroll up for more." or "Type ⌘N for next file." You may abbreviate words, but do not use icons, since they look like buttons to click on.

Kits

EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN
EINSTEINSTEIN

mozart

upside
down

Gutenberg
Gutenberg
Gutenberg
Gutenberg

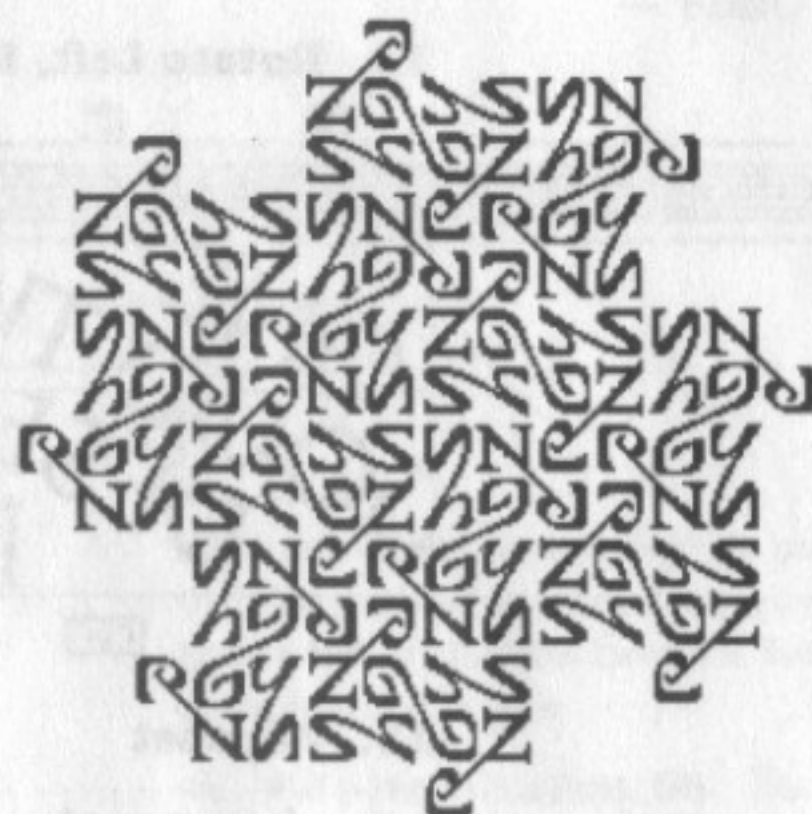
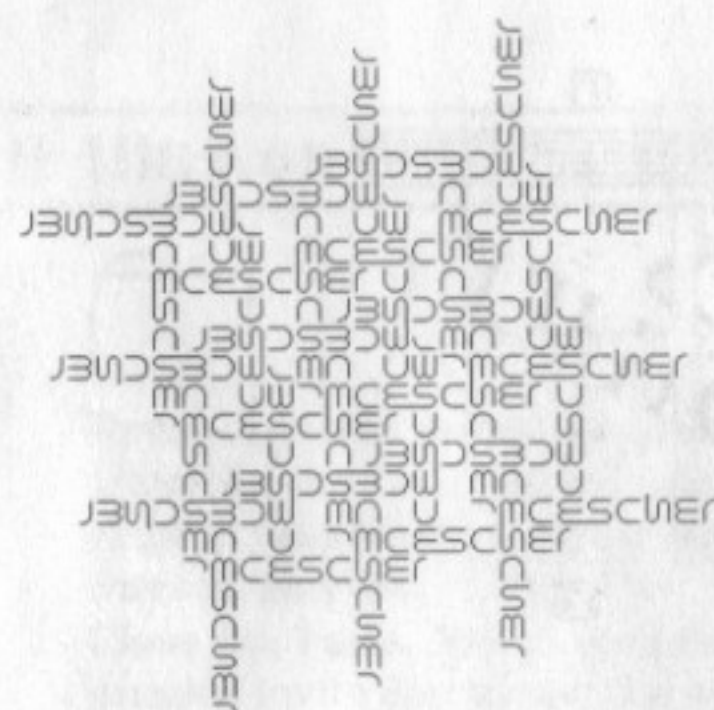
mirror

MAJOR
NO. 102

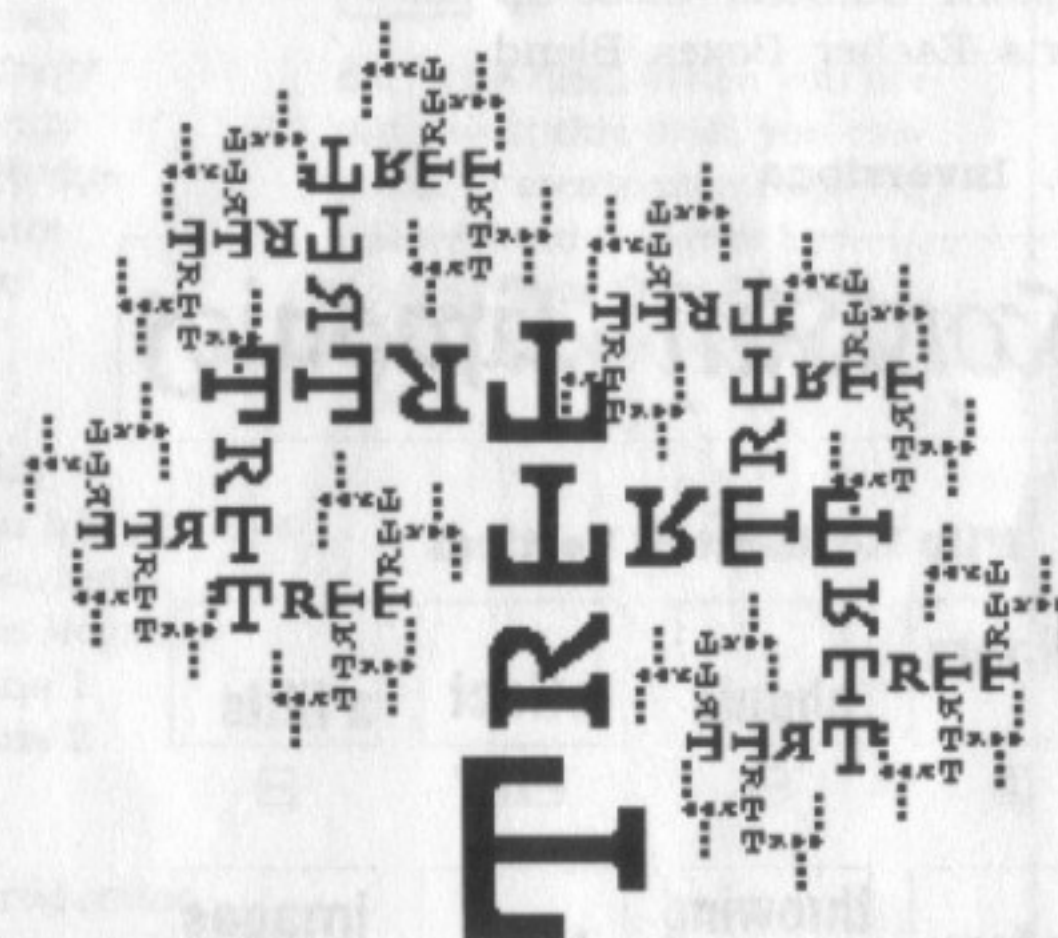
PROBLEM
SOLUTION

Each of the designs above is an inversion from the book *Inversions* by Scott Kim. An *inversion* is a word that reads in more than one way. It may read the same right side up and upside down. It may read the same in its mirror image. Or it may exhibit some other striking form of dual readability.

Kits is a folder on the software disk. It contains puzzles made from the designs on this and the following page. Each puzzle gives you a portion of the design on the screen. Your challenge is to use the Flips DA and MacPaint tools to recreate the design. For a greater challenge, close this booklet and try assembling the designs in Kits without looking at the completed versions on these pages.



*infinityinfin
yinfinityinfi
tyinfinityin
ityinfinity*



Can you identify the symmetry and structure of each design? How does the image repeat itself? By recreating the design in MacPaint you may get a closer view of the visual trickery and magic in each image. You can then go on to recreate this trickery in puzzles and designs of your own.

Answers

Page 26 in this booklet (Blend)

IS, AY, ED, HX, FH

IS, AY, ED, HX, FH

IS, AY, ED, HX, FH

BLACK / WHITE

Page 28 in this booklet (Boxes)

All that glitters isn't gold.

Many hands make light work.

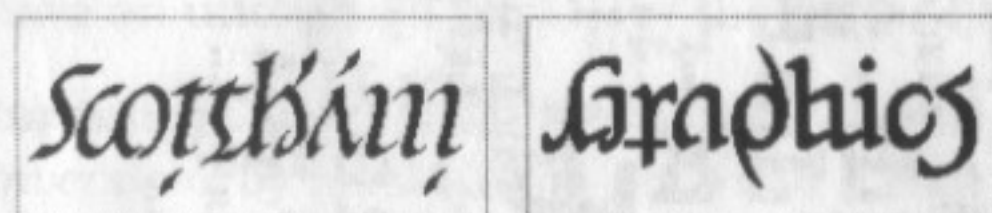
Too many cooks spoil the broth.

Illusion Infinity Tessellation

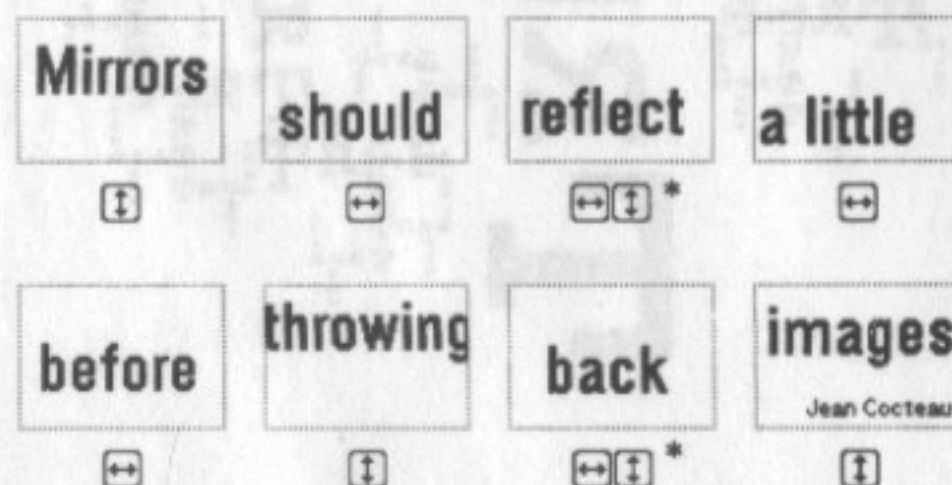
Flipfont Edmond Close-up

Parts Escher Boxes Blend

10. Inversions

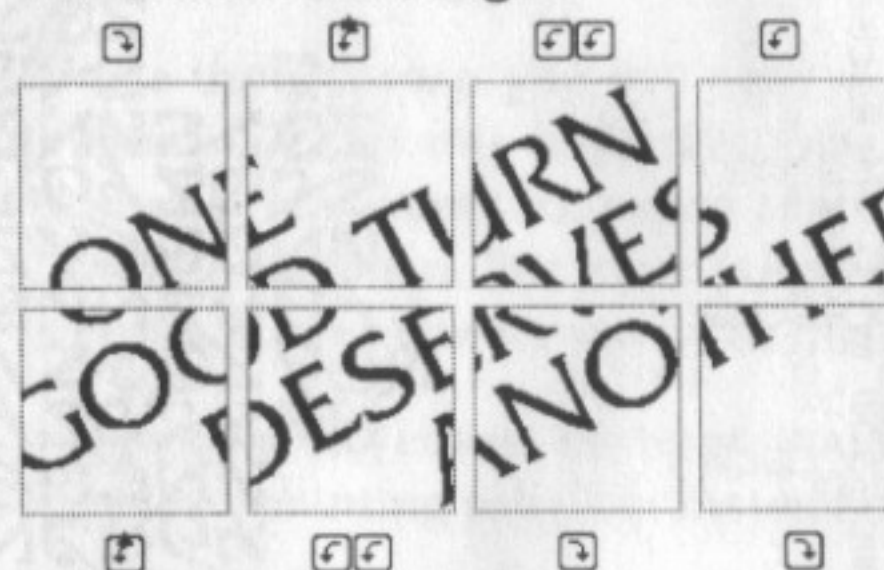


11. Flip Horizontal, Vertical



* Flip Horizontal, Flip Vertical =
Flip Vertical, Flip Horizontal

12. Rotate Left, Right



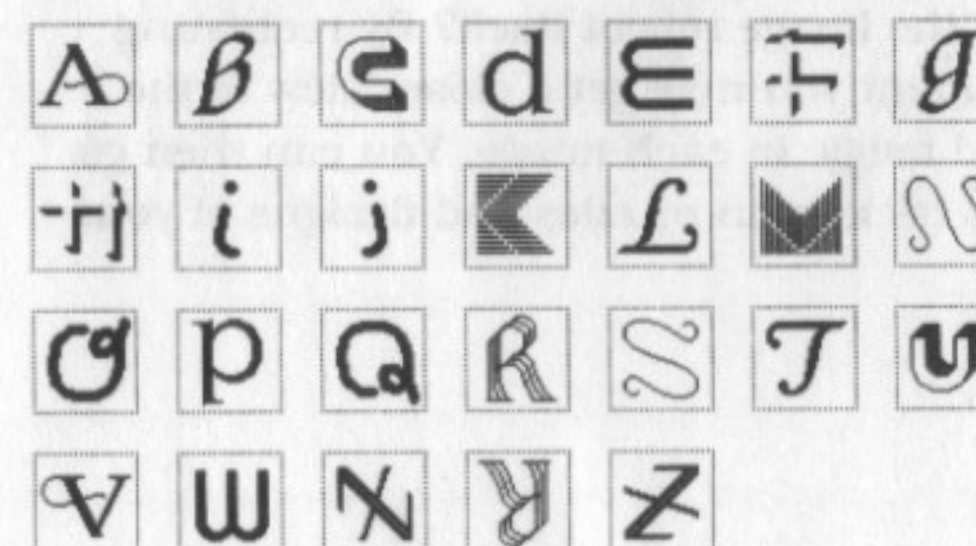
13. Flipabet



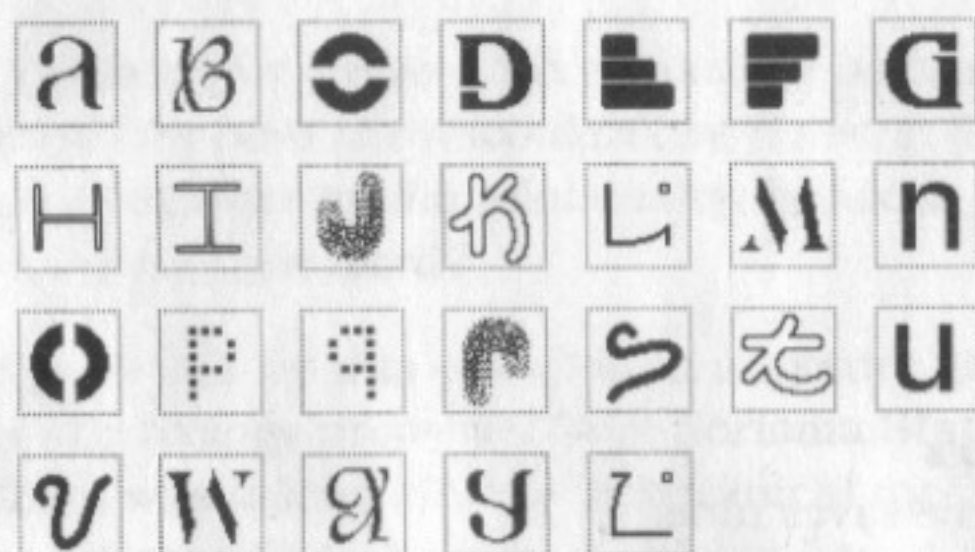
* The following operations are equivalent:

$$\begin{aligned} \text{FH} \text{ then } \text{FV} &= \text{FV} \text{ then } \text{FH} = \text{FH} \text{ then } \text{FH} = \text{FV} \text{ then } \text{FV} = \text{FV} \\ \text{FH} \text{ then } \text{FH} &= \text{FV} \text{ then } \text{FV} = \text{FH} \text{ then } \text{FV} = \text{FH} \text{ then } \text{FH} = \text{FV} \text{ then } \text{FV} = \text{FV} \end{aligned}$$

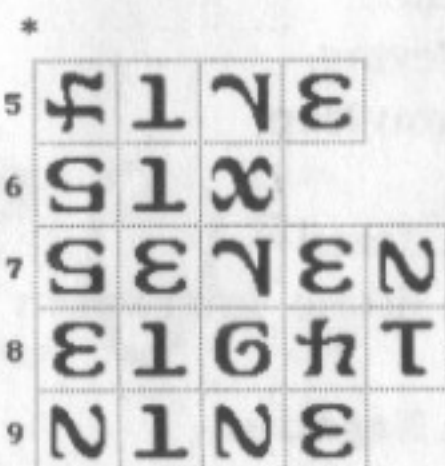
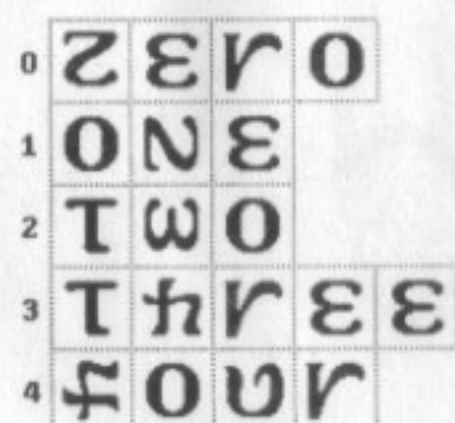
14. Halphabet



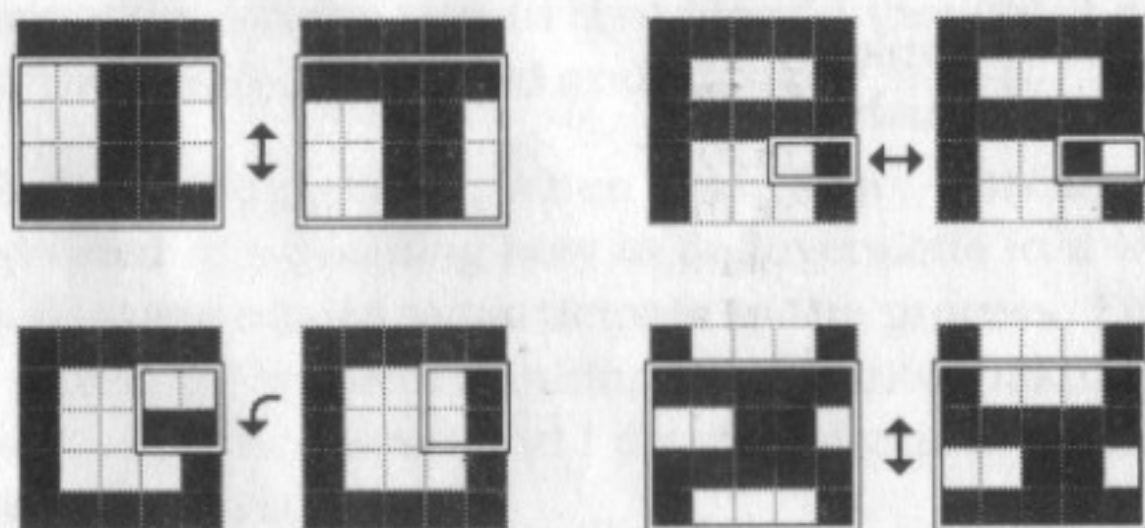
14. Halphabet (continued)



15. Numbers



16. Flip Pairs



Puzzles that have more than one answer are marked with an asterisk (*).

20. Zebra Examples

identical/opposite: Type the two words separately, select the top half of *identical* with the marquee, and move it onto the top of *opposite*.

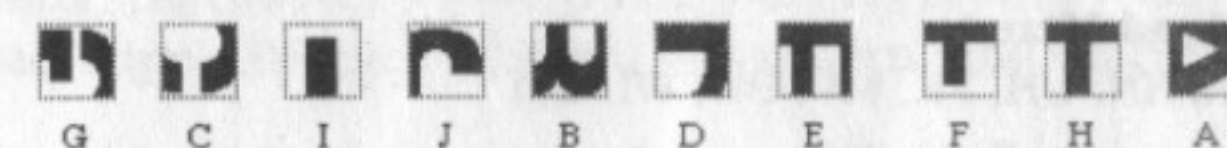
fade: Type the word, select the bottom fourth with the marquee, hold the Shift, Option and Command keys, drag the selection down, select a white pattern, and use the spray can to whiten the bottom of the word.

phase: Type the word, select the bottom fourth of the word with the marquee, drag the selection right a little until white stripes align with black stripes, and choose Invert from the Edit menu.

22. Flipfont Typing

PHILIP — dHITId
CATHY — jVLHh
William — M!jj!ew
Anne — Vuua
Larry — TVJJh
Linda — j!upe
bud — qnp

24. Closeup Match



26. Parts Upper, Lower

- a. piano
- b. plane
- c. bland
- d. blond
- e. prone

27. Parts Straight, Curved

- a. treat
- b. happy
- c. puddle
- d. chance
- e. decode
- f. letterforms
- g. remarkable
- h. pinstriped
- i. minimum
- j. lackadaisical
- k. bedecked

29. Blend Positive

VI, OS, ZX, TL, YH, TH, MA, ZN, BK

30. Blend Negative

OX, DK, VI, NO, MW, TH, ZN, PJ, HI

31. Blend Mixed

XO, TA, XN, UH, FE, MV, BD, WI, GQ

33. Boxes Languages

- a. Italian
- b. French
- c. English
- d. German
- e. Swahili
- f. Chinese

34. Boxes Sayings

- a. A stitch in time saves nine.
- b. All's well that ends well.
- c. Beggars can't be choosers.
- d. Silence is golden.
- e. Seeing is believing.
- f. Look before you leap.

36. Tessellation Jams

mystery, monkey, fitting, interwoven

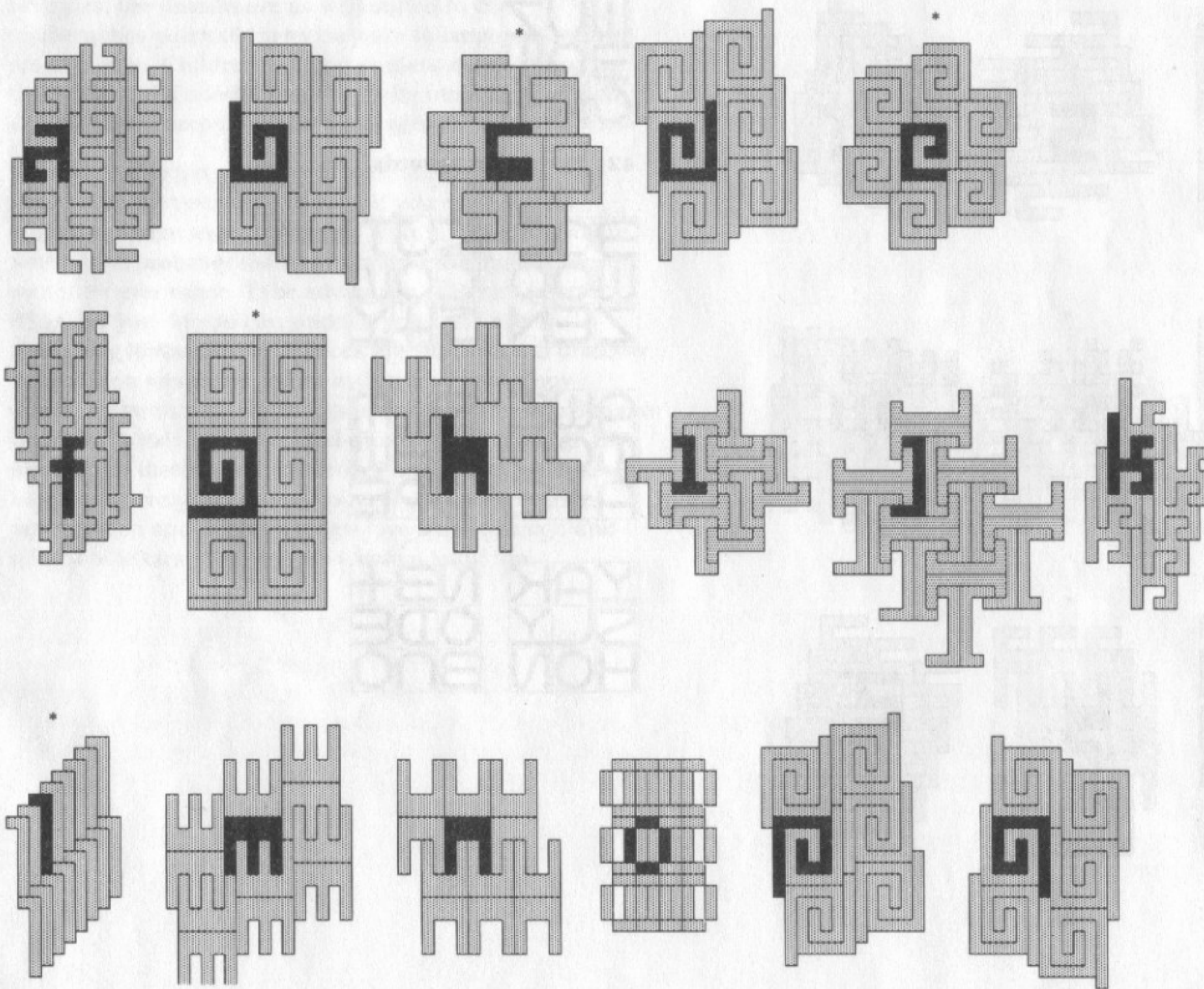
37. Tessellation Negative

soar	wax
zone	cat
musician	

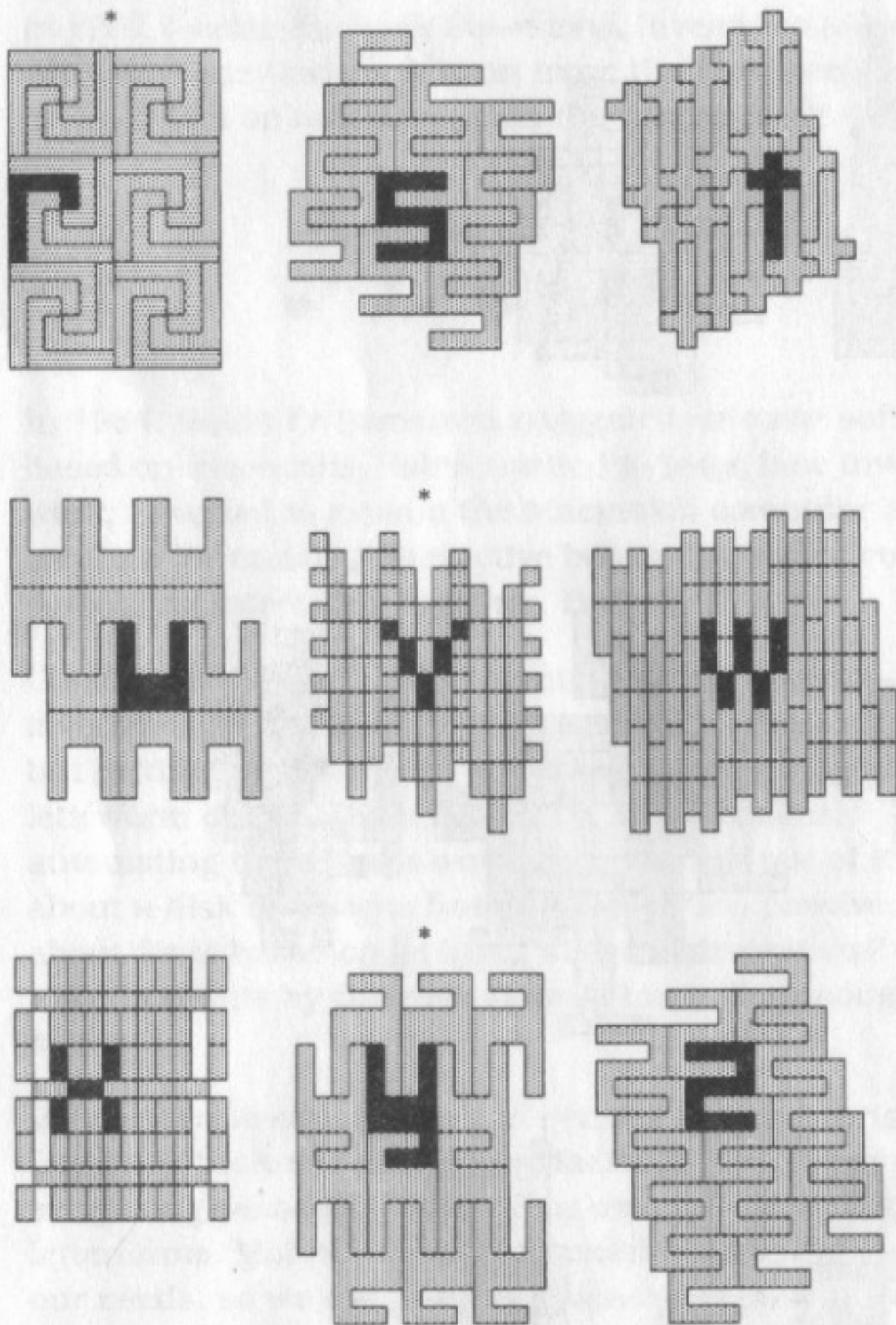
read	sank
what	push

Puzzles that have more than one answer are marked with an asterisk (*).

38-39. Tessellation Letters (in alphabetical order)



38-39. Tessellation Letters (continued)



41. Escher Crossword

W	U	Z
3	O	W
O	A	+

42. Escher Crosswords

3	O	O
W	O	O
Z	E	N

S	U	N
C	O	W
S	H	Y

A	W	E
T	O	O
A	+	E

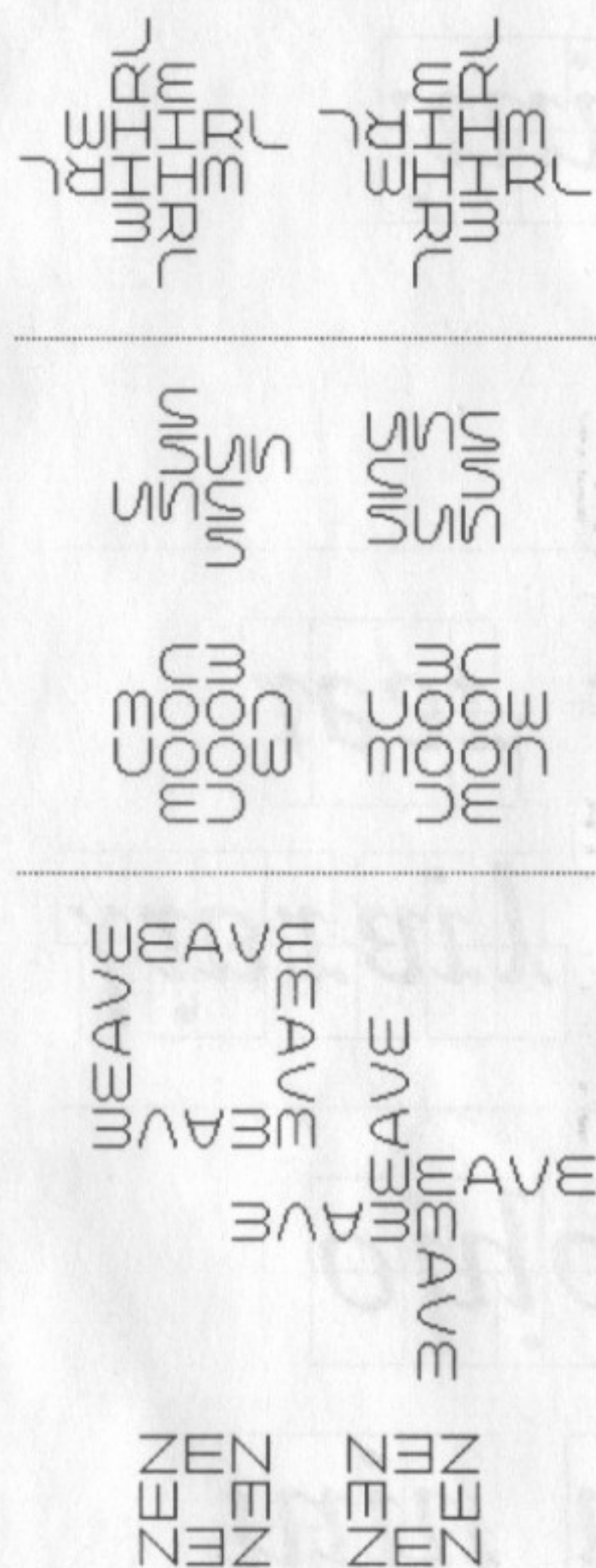
E	L	M
P	E	W
A	P	E

Y	A	K
S	L	Y
H	O	N

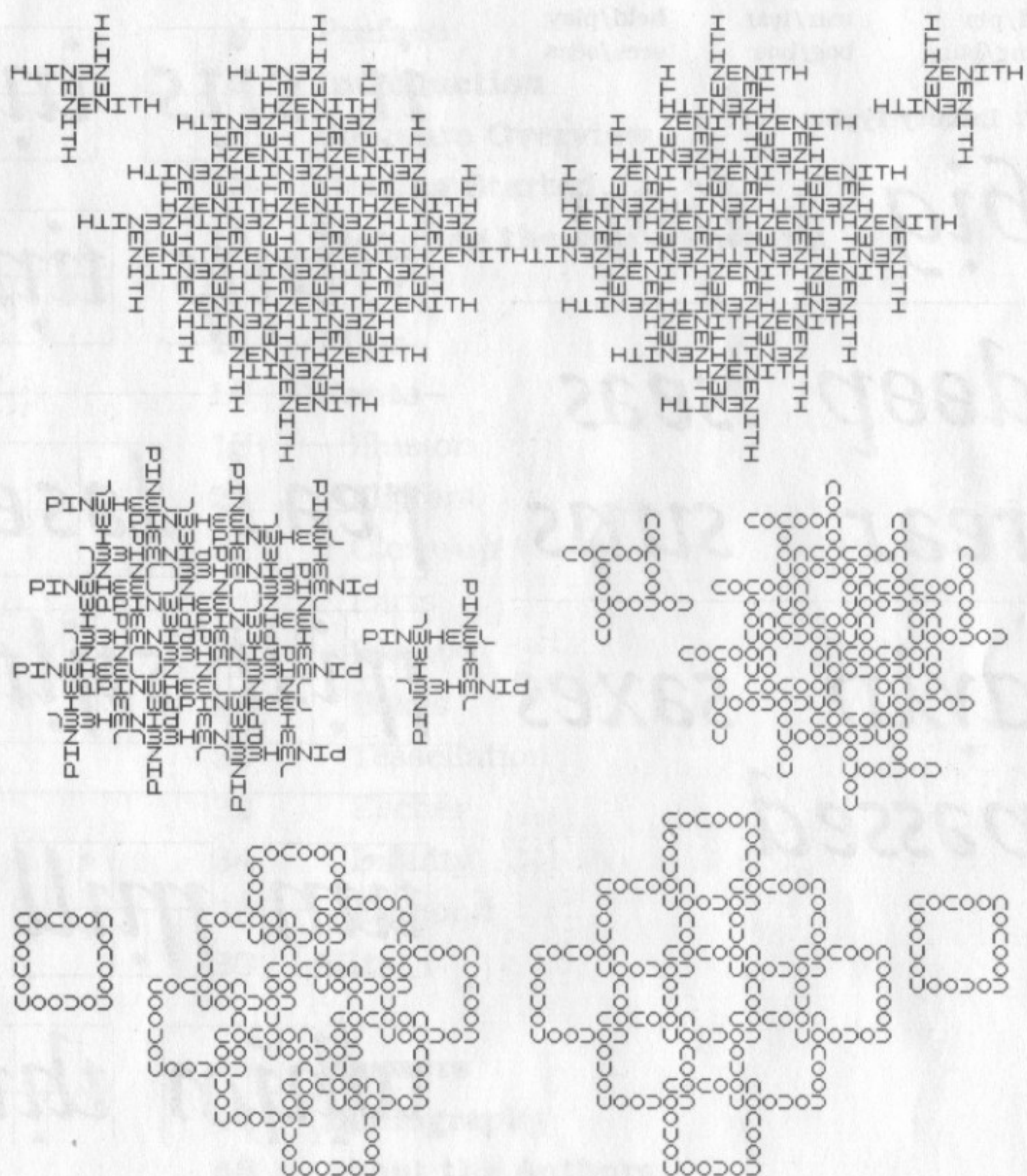
N	3	+
O	D	E
3	N	O

Puzzles that have more than one answer are marked with an asterisk (*).

43. Escher Pinwheels



44. Escher Patterns



46. Infinity Flipping

did/pip

tear/tear

held/play

bang/bang

bog/boa

sees/seas

47. Infinity Typing

big key

deep seas

rear suns

avid saxes

passed

48. Infinity Assembling

it sits in inn

stints tin

real laser tear

trill stilts library

tin mill ohio

whim thin hint

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Hofstadter, Douglas. *Metamagical Themas: Questing for the Essence of Mind & Pattern*. New York: Basic Books, 1986. ISBN: 0-553-34279-7. Philosophical essays on thought and creativity. Includes several of Doug's *ambigrams*—his word for inversions (or is *inversions* my word for *ambigrams*?).

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Kim, Scott. *Inversions*. New York: W. H. Freeman and Company, 1989. ISBN: 0-7167-2044-2. You've seen the software; now read the book. Dozens of full-page lettering designs, plus essays on symmetry, visual perception, lettering, music, and art.

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Shushan, Ronnie, ed. *Games Magazine Big Book of Games*. New York: Workman Publishing, 1984. ISBN: 0-89480-632-7. A circus of entertaining visual puzzles drawn from Games magazine.

U&lc. New York: International Typeface Corporation. The house journal of ITC is an exuberant celebration of typefaces and typographic play. *U&lc* stands for "upper and lower case." You can write ITC at 2 Hammariskjold Plaza, New York NY 10017.

About the Authors

Scott Kim (author, puzzle and font designer) enjoys finding new ways to merge art and science. He is best known for his book *Inversions*, published in 1981.

His early interest in mathematics was fueled by reading all the puzzle books in the local library. He inherited interests in music from his mother, who is a piano teacher and organist, and intercultural bridge-building from his father, who is a personal counselor and minister. At Stanford University he studied music, mathematics, and computers with equal enthusiasm, receiving a bachelor's degree in music and an interdisciplinary doctorate in computers and graphic design.

His work with computers and letterforms includes research at Stanford on Donald Knuth's typeface design programming language Metafont, screen font design for Information Appliance, logos for Silicon Graphics and Ford Aerospace, and free-lance lettering design for magazines. Most recently he has worked as a human interface designer at Information Appliance, a company founded by Jef Raskin, the originator of the Macintosh computer.

In the future he would like to teach people to use informal drawing in their everyday work, create an entirely visual mathematics curriculum, and design a fundamentally simpler type of personal computer.

Robin Fe Samelson (author, editor, product designer) likes to make complex ideas simple, explicit, and fun to learn. *Letterforms & Illusion* is her first major release as a product designer.

She has worked for more than ten years as a media and communications consultant. She comes from a theatrical family (her mother was an award-winning stage actress and comedienne) and completed a B.A. in Theatre Arts and Communications in 1976 with a stop in Mexico for cultural anthropology study along the way. Since her work both on and behind the stage, she has explored many other media, starting with radio drama in college and print media for several years after. A move to Palo Alto in 1981 put her in the world of computer graphics and high technology, where she provided consulting services in new product introductions and media relations.

In April of 1987, she took leave from the technology environment of Palo Alto and began studying Native American culture, botanical medicine, physiology, and earth system science, subjects which may find their way into her future products.

Bernard DeKoven (advisor, play designer) has spent more than twenty years exploring the relationships between play and learning, games and growth. Working with the School District of Philadelphia, he designed a totally new kind of curriculum, based solely on children's games, to help elementary school children develop much-needed social skills. Mr. DeKoven carried this same theme to wider audiences as contributing editor to *Games Magazine*, *Simulation/Gaming News*, and *Gifted Children Monthly*, and as a game designer for Ideal Toy Company, Epyx, Children's Computer Workshop, and Mindscape. For the last five years he has been focusing on bringing his methods to the business world via his pioneering work in computer-enhanced meetings. He lives in Palo Alto, California.